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ABSTRACT

Intended as a resource for teachers of grades four and up who are eager to improve their students' thinking skills while teaching their regular curriculum, this booklet contains activities that can be used to teach a new concept or to review a previously taught skill. Following an introduction, the topics of the chapters of the resource guide and the activities included in each are as follows: (1) basic thinking skills (overlooking the familiar, items in sequence, gossip game, remembering, misinterpreted actions, eyewitness reporting, and geometric puzzle); (2) critical thinking (statement bee, what's my value, conflict skits, clearing up conflicts, when the cheapest food was best, catching a cold, and social assumptions); (3) creative thinking (what is an ecotect?, inventions, using materials creatively, new and different thinking, and what if...); (4) problem solving (detectives, sabotage, problem posing, jumping to conclusions and assumptions, puzzling problems, static electricity, paper planes, memory, performing tests, how high?, problem finding, and brainstorming solutions); and (5) decision making (pressure on the witness, to tell the truth, you be the judge, consumer research, and food shopping blues). All activities are coded for subject appropriateness, including art and health/family living. (SKC)

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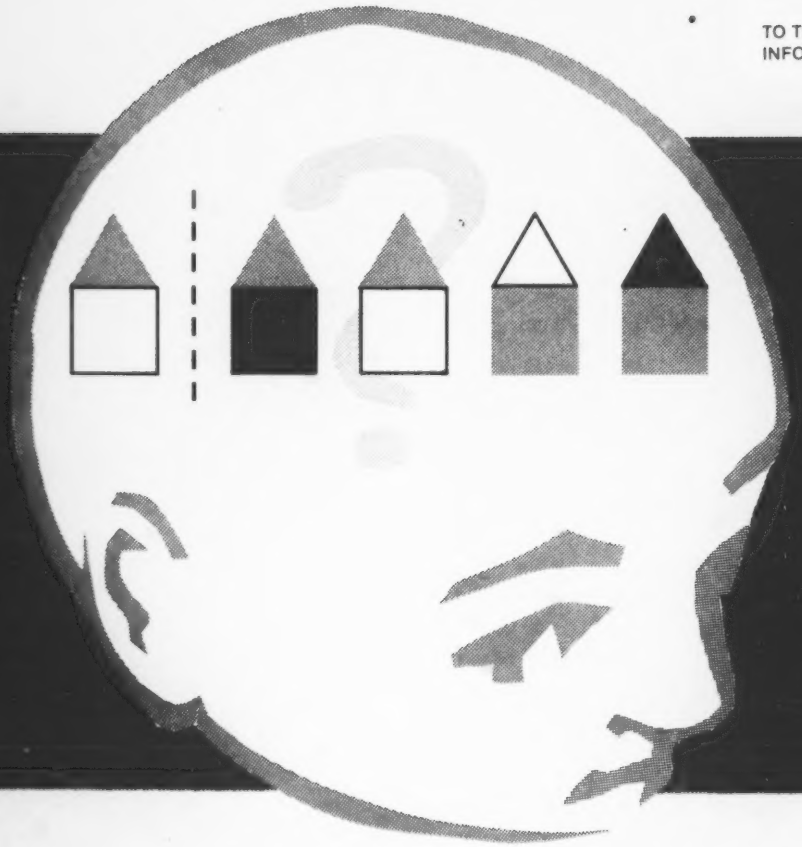

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I. INTRODUCTION

I. INTRODUCTION

Classroom Activities in Thinking Skills is a resource for teachers of grades four and up who are eager to improve their students' thinking skills while teaching their regular curriculum. The activities in this resource book require from 10 to 30 minutes each and are designed to be used with the entire class. They can be used to teach a new concept or to review a previously taught skill. They should be seen as extensions or expansions of regular class work. The goal of all these activities is to help students sharpen their thinking skills and develop more effective thinking habits through classroom interaction. Students are encouraged to become active learners rather than the passive recipients of information. The role of the teacher in these activities is to guide student learning rather than to convey the right answers. The teacher helps students take responsibility for their own thinking and learning.

The activities have been collected from several sources. Many of them were adapted from curricular programs developed at Research for Better Schools by John W. Thomas. Others were developed by Janice Kruse. All have been used successfully by regular classroom teachers with students of varying ages and ability levels. Yearly updates to this collection are planned and you are encouraged to submit candidates for inclusion. Activities should actively involve students in thinking and promote an atmosphere of inquiry in the classroom. The author's name and school district or organization will be noted for each activity published. To be considered, activities should be submitted to:

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*The classification of thinking skills activities used here is based on the tri-level model of thinking developed by Barbara Presseisen.** *The first level refers to the cognitive processes; the second, the metacognitive; and the third, the epistemic. This book concentrates on the first level, the cognitive skills, although many activities do contain metacognitive elements. Presseisen divides the cognitive level into basic skills and higher order skills. Basic thinking skills activities focus on single skills related to perception, memory, and reasoning. The higher order thinking activities are classified as problem solving, decision-making, critical thinking, or creative thinking activities. These activities require the use of a variety of skills. Often activities classified as one type will involve skills associated with another type and not all students will use the same skills for a given activity. For example, critical and creative thinking processes both may be used to solve problems and to make decisions. Further, making decisions is often a part of problem solving and vice versa. Therefore, the classification labels used are intended to guide the use of activities not to define them.*

All activities are coded for subject appropriateness as well. The codes on the upper right corner of each page suggest subjects in which the activity may be incorporated. The coding is illustrative, not exhaustive; use in other subject areas may also be appropriate.

---

*Presseisen, B. Z., (1987). Thinking skills throughout the curriculum, a conceptual design. Pi Lambda Theta, Bloomington, IN.

any subject =

art =

math =

health/family living =

science =

language arts =

social studies =

In many cases, the teacher may be able to substitute more timely, site specific, or germane materials for those provided with the activities. For example, any list of vocabulary words can be used in activity V.8 (Memory) and any math answers can be used in activity V.11 (Problem Finding). The level of difficulty will be determined by the materials selected for use. Substitution of content should be considered carefully, as the learning outcomes may be affected.

In selecting activities, if the main purpose is to teach a specific thinking process, it would be best to review all the activities under that classification. If the purpose relates to a specific subject, use the subject codes on the top right corner to select activities for review. A suggested first step in reviewing any activity is to look at the "objective" and "summary" sections. In most cases these will give you enough information to decide whether you can use the activity.

Each activity also includes a list of materials, an estimate of time, directions, and, in some cases, points for discussion. The materials are usually commonly available objects. A copy of materials specifically developed for any activity can be found following the activity description; these may be copied for classroom use. Time estimates are only that; most activities can be expanded and many can be condensed. Directions vary with the type of activity. In the more complex activities, the points for discussion are embedded in the directions; the more generic activities have points for discussion as a separate entity. These points for discussion are not intended to be all-inclusive. Often the teacher will want to add points which relate the activity to the students' prior knowledge or to future activities.

II. BASIC THINKING SKILLS

II.1 OVERLOOKING THE FAMILIAR

OBJECTIVE: To demonstrate that people tend to overlook details of things which seem familiar to them.

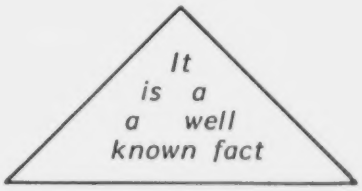
SUMMARY: When given two simple printed phrases to read, most students will fail to notice that a word has been printed twice.

MATERIALS: Two large pieces of posterboard [8" x 10"] cut in triangular shapes.

TIME NEEDED: 5 to 10 minutes.

DIRECTIONS:

1. On one piece of poster paper, print the following statement:



(NOTE: "a" is repeated.)

2. On the other piece, print the following statement:

(NOTE: "the" is repeated.)

3. Tell the students you will hold up something for them to read.

4. Hold up the first poster for a very few seconds. Ask the students to write down exactly what they saw.

5. Hold up the second poster for a few seconds. Put it down. Ask the students to write down what they saw.

6. Now check what the students wrote.

POINTS FOR DISCUSSION:

1. Why do you think some students misread the signs? (The responses to this question will probably center around taking familiar things for granted, or not observing familiar or obvious things carefully.)

2. What does this tell you about the observations we usually make?

II.2 ITEMS IN SEQUENCE

OBJECTIVE: To have the students discover the limits of certain aspects of their memory. Can be used to test visual and/or aural memory. Can be used to compare the effectiveness of eye versus ear for reliability of testimony.

SUMMARY: Students are asked to repeat lists of items presented either verbally or visually.

MATERIALS: The teacher should prepare several sets of 15 objects of any kind, and several lists of 15 objects.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Select a pair of students. Call one student the "witness," and the other student the "actor."
2. Have the "actor" read off the first five items from a list of 15.
3. Have the "witness" repeat the five items verbally in sequence.
4. Have the "actor" repeat the list again, adding another item. The "witness" should repeat the expanded list in sequence.
5. Continue this process, adding a new item each time the list is given until all 15 items have been named or the witness makes an error or gets stuck. Record how many words were given.
6. Repeat this process with several pairs of students, changing the list with each pair.
7. After a number of pairs have tried this experiment and you have enough information to discuss averages and general processes, change the experiment, so that instead of a list of objects, the "actor" will produce the objects themselves.
8. Again have the students work in pairs, having the "actor" show the "witness" the objects, concealing them and then asking the "witness" to name the objects. Repeat this procedure with several pairs of students. You may want to use some or all of the same pairs of

students in the visual experiment that you used in the verbal experiment in order to increase the validity of the comparison between the two methods of remembering.

POINTS FOR DISCUSSION:

1. *What does this activity tell us about the capacity of eyewitnesses?*

2. *Which sequence did students remember best?*

3. *Are there any possible generalizations that can be drawn from this activity? Can you draw any conclusions about the reliability of verbal vs. visual information from the results of this experiment?*

II.3 GOSSIP GAME

OBJECTIVE: To observe the lack of reliability of secondhand information. To observe the process by which events are distorted in re-telling.

SUMMARY: A student tells a story to another student who has not heard it. The second student, in turn, tells the story to a third, who tells a fourth, and so on. The process may be tape recorded and then played back for analysis.

MATERIALS: Gossip Game Story (follows).
Recorder and microphone (optional).

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Choose six volunteers from the class (Students A, B, C, D, E, and F). Have Student A remain in the front of the room. Instruct students B, C, D, E, and F to wait in the hall until called.

2. Pick one student from the remainder of the class who will read the story out loud to Student A. (Begin recording as the story is read.)

3. Call student B into the room. Student A must now repeat to Student B the story just told.

4. When Student A finishes retelling the story, call in Student C. Student B then recounts the story to Student C, and so on.

5. After Student F has finished telling his or her version of the story, refer all the students in the class to a copy of the original story. If a tape recorder was used, play back the tape and stop at each retelling to consider the omissions, exaggerations, and other changes that were made.

POINTS FOR DISCUSSION:

1. What were the first changes that occurred in the story? What changes followed?

2. What types of details seemed to change most often or most dramatically?

3. Why did these changes occur?

4. How reliable is secondhand information?

Gossip Game Story

The scene is a movie theater. On the screen, a policeman is chasing a a man named Ralph for stealing money from a candy store. A short, dark-haired boy gets up and goes to the lobby. Another boy, whose name is Paul, is putting money into a candy machine. Paul is tall, has blonde hair, and is wearing a brown jacket. No candy comes out of the machine and no money is returned, so Paul starts banging the machine. The manager sees the two boys at the machine and comes over. Paul steps into the theater and the manager grabs the other boy. He says he is going to call a policeman. On the screen, Paul watches as the policeman arrests Ralph for robbing the candy store.

II.4 REMEMBERING

OBJECTIVE: To demonstrate that many obvious details are seen but not really noticed and that memory of such details is apt to be faulty.

SUMMARY: Students are asked to recall what clothing other students and their teacher wore the day before. Many of them will be unable to do so.

MATERIALS: None.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Each student is asked to describe in writing what clothing he or she wore the previous day. The teacher should also prepare a description.
2. Each student is asked to describe verbally or in writing what one other student was wearing.
3. Then each student's report is compared to the actual description of the other student's attire.
4. Next, as a whole or divided into groups, the class is asked to describe what the teacher was wearing the previous day.
5. The teacher then reveals what clothing he or she wore.

POINTS FOR DISCUSSION:

1. For those who did remember, were there any special reasons why they did so? For those who did not remember, what were some possible explanations?
2. Are there things about a situation or a person that tend to be remembered more easily?
3. Are the students able to form a generalization about the reliability of eye-witness reports?

II.5 MISINTERPRETED ACTIONS

OBJECTIVE: To show that a partial view of an event is open to many interpretations.

SUMMARY: Students mime a simple action which is partially hidden from view. Other students must decide what activity is being depicted.

MATERIALS: A large box, screen, bookcase, or anything which can be used as a shield. Props, if desired.

TIME NEEDED: 15 minutes.

DIRECTIONS: This activity can be done in groups or as a class.

1. Have each student, or group of students, devise an action which, when pantomimed, is open to a number of interpretations [e.g., an arm raised over the head, as though holding something, and then brought down with great force].
2. The students then perform the actions behind a box, bookcase, or something similar which partially obscures the view of the rest of the class.
3. The observers try to determine what action is being performed [e.g., hammering nails, hitting someone].
4. The actor then reveals what he was doing [e.g., swatting a fly].
5. Further examples: A student with hands together and bent over as though choking someone might be trying to lift a heavy object; a student bending over and standing up may be looking for something in a low cabinet or doing exercises.
6. Emphasize that for reliable interpretation of an event, an observer must have an unobscured view of the event and must know the entire context of the event.

POINTS FOR DISCUSSION:

1. How many times were the observers able to give a correct interpretation on the first guess?
2. On what information or assumptions did they base their interpretations?

II.6 EYEWITNESS REPORTING

OBJECTIVE: To assess students' ability to observe and report details accurately. To demonstrate the usual unreliability of observations.

SUMMARY: Students are asked to give descriptions of an intruder who suddenly enters and leaves the room, creating a disturbance in the process.

MATERIALS: One student from another class (involves pre-arrangement).

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Pre-arrange with another teacher to have a student (preferably someone not known by many of your students) suddenly run into your classroom, do something (take some books, push the teacher, etc.) and run out.

2. Begin your regular lessons as usual. At the time of the disturbance, react with a startled look, perhaps adding some appropriate actions.

3. After the event, have each student write down a description of the person (clothing worn, etc.) and describe in detail what happened.

4. When the students have finished their reports, have the person who caused the incident come back to your class and re-enact what actually happened.

5. Compare the students' description of this person and their versions of the incident.

POINTS FOR DISCUSSION:

1. Did the reports of various students differ? If the reports were inconsistent, discuss the reasons for their inconsistency.

   a. Did students report what they saw?
   b. Did they use words which showed feelings about the people or the events?
   c. Did distance from the event affect the reliability of the students' descriptions?

2. *Did bias enter into the descriptions of the person or incident?*

   a. *Did any reports favor the teacher?*
   b. *Did any reports favor the intruder?*

II.7 GEOMETRIC PUZZLE

OBJECTIVE: To give students practice in comparing shapes and identifying common attributes.

SUMMARY: Students search for the 12 possible shape configurations of five squares.

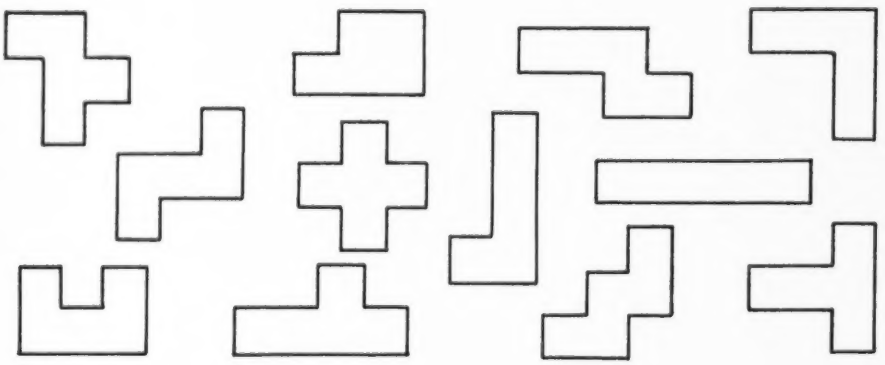
MATERIALS: Rulers, chalkboard, and chalk.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Ask students to draw a shape made up of five one inch squares. See how many drew the same shape.
2. Inform students that there are twelve possible configurations and tell them to see how many of these they can discover (draw) in five minutes.
3. Have students draw answers on chalkboard.

Answers:



POINTS FOR DISCUSSION:

1. Ask students to tell how various pieces are alike and how they are different. (Shapes differ, area and perimeter are the same.)
2. Have students identify the shapes which look like letters of the alphabet.

III. CRITICAL THINKING

III.1 STATEMENT BEE

OBJECTIVE: To have students differentiate factual statements from statements of personal taste and value judgments.

SUMMARY: Students are divided into two teams. Play evolves in spelling bee fashion without eliminating any team members. Every member of both teams is challenged three times: to identify a type of statement, to formulate a type of statement, to formulate a type of statement within a matching set. Points are accumulated for correct answers.

MATERIALS: List of Statements (follows).

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Divide the class into two equal teams.

2. Draw two columns on the chalkboard for recording scores as the activity proceeds.

3. Alternate questions between the two teams, asking each student in each team a different question. When every student has responded to the first challenge, go on to the second challenge and finally to the third challenge.

4. Challenges increase in order of difficulty.

   a. Identification.
   Read any statement from the list. Challenge the student to identify the type of statement--fact, personal taste, value judgment. Score one point for each correct answer.

   b. Statement Formulation.
   Give the student any common noun as a subject and name one of the three types of statements. Challenge formulation of a statement of the type named using the given noun as the subject. Score one point for each correct answer.

   c. Consecutive Statements.
   Give the first student a subject. Challenge formulation of any one of the three types of statements using the given subject. Do not ask for identification of the type of statement. Challenge the second student on the same team to use the same

DIRECTIONS (continued):

subject and formulate a statement of a different type. Challenge the third student on that team to complete the matching set by formulating a statement of the one remaining type using the same subject. Ask for a volunteer from either team to identify the three types of statements in the order in which they were used.

Score one point for each correct statement.
Score an additional three points if all three types of statements were used to form a matching set.
Score two bonus points for the team whose member identified the order in which the types of statements were used.

5. During the activity, students may challenge answers which they think are incorrect. In some cases, statements of personal taste and value judgments may be hard to distinguish. The teacher may be the final judge in discussions or disagreements.

6. When every student on both teams has had an opportunity to respond to every challenge, add up the scores and announce the winning team.

POINTS FOR DISCUSSION:

1. Why is it important to differentiate factual statements of personal taste and value judgments?

2. Why should we give more weight to factual statements (in an argument or court testimony)?

3. Would fictional characters seem real if all we knew about them were facts?

List of Statements

The three types of statements are:
- Factual statements
- Statements of personal taste
- Value judgments

FACTUAL STATEMENTS

1. There are many kinds of computers.
2. Cocoa is one of the major exports of West African countries.
3. Library records show that more non-fiction books have been borrowed this year than last year.
4. A bad case of measles could cause blindness.
5. My mother gets mad if I wear a pair of socks for a week.
6. Students who cut class usually get called to the office.
7. Baseball is a popular sport in America.
8. My mother told me that my bedroom is a mess.
9. Maria is Italian.
10. I spent $100 today.

STATEMENTS OF PERSONAL TASTE

1. I prefer to use an Apple computer.
2. I like chocolate candy but I hate chocolate cake.
3. My favorite author is Judy Blume.
4. Don't sneeze at me - I'd hate to get a cold.
5. I'd like to go barefoot all summer.
6. I would like to cut math class.
7. I enjoy playing tennis.
8. I like that kind of music.

9. I like Italian food.
10. As far as I'm concerned, $4.00 an hour is a low wage.

VALUE JUDGMENTS:

1. Computers should be built to last.
2. People with bad teeth shouldn't eat chocolate.
3. You shouldn't believe everything you read.
4. All children ought to be vaccinated against serious diseases.
5. Karen is the best swimming teacher at the pool.
6. It's important to attend church regularly.
7. It's better to be involved in a game than to sit watching.
8. Students should develop good work habits.
9. It's wrong to accuse a person without very good reasons.
10. It's wrong to spend more money than you earn.

III.2 WHAT'S MY VALUE

OBJECTIVE: To express and identify values used in a free discussion.

SUMMARY: Students are organized into groups of six. Each group is divided into two three-pupil teams (Teams A & B). Each student in Team A is assigned a value to represent--without naming it--in a free discussion. Members of Team B try to identify those values. Team roles are then reversed.

MATERIALS: Value Groupings and Subject Possibilities (follows). The teacher may reproduce this page for distribution to students.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Divide the class into groups of six.
2. Have each group divide themselves into two teams (A & B) of three students.
3. Assign the three values from one value grouping to the three members of Team A--one value to each team member. Do not allow the members of Team B to know the values. You may hand out groups of values, cut from a reproduction of the Value Groupings and Subject Possibilities page. Or, you may whisper values and subject possibilities to Team A members.
4. Instruct all Team A members to engage in a free discussion on a subject which will encompass their values. Subject possibilities are suggested with each values grouping, or students may think up one of their own. Each student must portray or express the value without stating it. For example: Not, "I think safety (the value) is important," but, "I think hijackers should be put in prison."
5. Tell members of Team B to work together as a group to agree on the three values being portrayed. Team B must guess all three values at once. They may freeze the discussion if they want to confer or need to question a member of Team A.

DIRECTIONS (continued):

6. Limit the playing time to five minutes. If Team B is unsuccessful in identifying the portrayed values, Team A reveals them.

7. Instruct the teams within each group to switch roles and repeat the process using a new grouping of values assigned by the teacher.

8. Since this is a complex activity, you may wish to demonstrate with a sample group before engaging the whole class.

POINTS FOR DISCUSSION:

1. Why are values important to individuals and/or society?

2. How do we commonly show what we value?

3. What are some common values in our society?

4. Do writers reveal their values? How?

Value Groupings and Subject Possibilities

VALUE GROUPINGS	SUBJECTS FOR DISCUSSION
Safety Adventure Obedience to the law	1. Spying for the government 2. Hijacking airplanes
Honesty Loyalty Popularity	1. Taking bribes 2. Voting in student council elections
Accuracy (avoiding errors) Speed Endurance (sticking with a task)	1. Playing basketball 2. Taking part in charity bike-a-thon
Personal independence Cooperation Obedience to authority	1. Paying taxes 2. Taking part in community activities
Justice (fairness) Objectivity (seeing how things really are) Prejudice (making prior judgments without facts)	1. Judging a contest 2. Urban renewal
Frankness (speaking openly) Secretiveness (hiding thoughts or opinions) Tact (considering feelings of others)	1. Disagreeing with your friends' opinion 2. Joining a secret society
Participation Indifference (I don't care) Caution	1. Being asked to join a picket line 2. Signing a petition

Moderation *Being relaxed* *Action*	1. *Attending a rock concert* 2. *Jogging*
Love of family *Kindness to all* *Egotism (me first)*	1. *Sharing world food supply* 2. *Waiting in line*
Respect for knowledge *Respect for skills* *Respect for power*	1. *Electing a government official* 2. *Building a computer*
Success with money *Fame* *Success in dealing with people*	1. *Choosing a career* 2. *Discussing a political figure*
Enthusiasm *Disinterest* *Open-mindedness*	1. *Designing the student center* 2. *Discussing whether school should stay in session during the summer*

III.3 CONFLICT SKITS

OBJECTIVE: To discuss points raised in dramatized examples of complex conflicts involving value judgments.

SUMMARY: Three short play scripts involving conflicts are dramatized by volunteers. Teacher leads discussions based on each script.

MATERIALS: Play Scripts A, B, and C (follow). Discussion questions are listed after each script.

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Tell the students that each of the play scripts will be read and discussed.
2. Ask for two volunteers to dramatize Script A. They may simply read without moving from their desks, or if they are willing, may come to the front of the class and accompany the reading with gestures.
3. After the dramatization, lead a discussion based on the questions following the script.
4. Repeat direction numbers 2 and 3 for the two other scripts.

Script A

Setting: The Girard dining room at dinner time.
Characters: Sandy Girard, age 18, and Martin, her 12-year-old brother.

SANDY: Eat your dinner. You're wasting food. Think of all the starving children in other countries.

MARTIN: But I'm not starving and I'm not wasting food. Listen, I could be well fed and healthy with only half the food I get.

SANDY: Prove it. Go on - show me statistics for growing kids.

MARTIN: O.K., but I read about it in a magazine at school. We don't have any books about nutrition around the house.

SANDY: So eat your dinner. Mom knows best.

MARTIN: Not on this she doesn't. You said I was wasting food. I say Mom is wasting it by giving me more than I need. I don't need this much to eat - especially not in the summer when I'm lying around and not using much energy.

SANDY: If you can't prove what you're saying, stop talking and start eating.

Script A Points for Discussion

1. What kind of argument are Sandy and Martin having?

   ANSWER: Argument over facts - how much food kids need to stay healthy.

2. Even though they are arguing about facts, each of them has stated an opinion. What are the opinions?

   ANSWER: Sandy says Martin is wasting good food, and that his mother knows best. Martin says he's not wasting food, it's his mother who is wasting food.

3. What if Martin located facts to show that growing children need less food than he is asked to eat? Would these facts prove that Martin's opinion is correct? Why can't opinions ever be proved true or false?

4. Sandy and Martin could not settle their factual argument because the facts were in books and magazines that were at school. Can you think of other kinds of factual arguments that would be hard to settle?

   ANSWER: When different books or other sources state contradictory facts, or when a fact has not yet been established and must be tested. For example: "I can swim faster than you can."

Script B

Setting: Back yard of the Johnson's house.
Characters: David Johnson, 14 years old, and his friend, Monty Parsons.

DAVID: Mom says I have to make up my own mind--guitar lessons this summer or camp.

MONTY: That's not hard. Come to camp with all your friends.

DAVID: I'd like to. We all had a good time last year. Being together at camp seems to make friendships really solid.

MONTY: Right. So come to camp.

DAVID: It isn't that easy. You know I like playing the guitar and if I want to improve my playing, I have to take the lessons.

MONTY: Well, that's your thing.

DAVID: Yes it is, and doing something really well--just for my own benefit--is also important to me.

MONTY: You have to make the choice, that's all.

DAVID: All? You make it sound so easy, but it isn't. I just can't make up my mind.

Script B Points for Discussion

1. This conflict situation is not between two people--it's within one person. Which of David's values are in conflict?

   ANSWER: Enjoyment with friends and doing something really well.

2. Do you sometimes have to make a decision which involves choosing between conflicting values?

   SAMPLE ANSWERS:

   a. Spending time on school work to improve grades vs. spending time on sports activities to improve skills.

   b. Being loyal to one special friend vs. being loyal to a group of friends.

   c. Being kind to a younger brother or sister vs. wanting personal privacy and time of your own.

3. How do you deal with such decisions? Do you work it out on your own? Do you talk it over with people who are in some way involved? Do you talk it over with a good friend, your parents, or some other adult whose opinion you respect?

4. Could David find a compromise solution?

   ANSWER: He could try to arrange for guitar lessons at camp.

Script C

Setting: Living room of city apartment. Pat's suitcases are standing by the door.

Characters: Pat and Debbie, young women in their mid-twenties, who have been friends for six years and have shared the apartment for the last two.

DEBBIE: There's still time to change your mind. You haven't sold your soul to the Army yet.

PAT: I'm not selling my soul. I'm joining the Army for four years so I can get experience as a news broadcaster.

DEBBIE: For four years you will have to obey orders. It's like going back to school.

PAT: In a way, yes. I have been guaranteed training and practice in broadcasting. It's in the contract and it's what I want.

DEBBIE: I couldn't do it. Nothing would persuade me to give up my independence.

PAT: Sometimes it's important for people to spend some time in a carefully set-up situation in order to get the experience and knowledge to do what they want afterwards. I want to work in broadcasting and this is the only way that it's possible.

DEBBIE: Are you really sure about that?

PAT: Look, I've tried everything. All the TV and radio people are very polite, but they all say, "No." So it has to be the Army.

DEBBIE: You're paying a high price.

PAT: Not really. I'll get the experience I need. I'll get paid. After four years I'll be able to get any job I want and all the independence I can handle.

DEBBIE: You hope.

PAT: O.K., so I'm taking a risk. But the alternative--taking a job I don't like and being miserable forever--is a much greater risk.

Script C Points for Discussion

1. What are Pat and Debbie discussing?

   ANSWER: Pat's decision to join the Army.

2. Pat and Debbie hold the same value. What is it?

   ANSWER: Personal independence.

3. Go through the script again, identifying factual statements, taste statements, and value judgments.

4. Why has Pat chosen to give up her personal independence?

5. In your opinion is Pat taking worthwhile risks? Support your opinion from the script.

6. Do you place independence high on your list of values?

7. Which values are so important to you that you would put them aside only under extremely unusual circumstances?

III.4 CLEARING UP CONFLICTS

OBJECTIVE: To identify sources of confusion and to formulate statements which clear up conflicts.

SUMMARY: Students dramatize three scripts which illustrate sources of confusion. They identify the mistakes and suggest statements which could be used to clarify the conflicts.

MATERIALS: Play Scripts A, B, and C (follow).

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Tell the students that each of the play scripts will be read and discussed.
2. Ask for two volunteers to dramatize Script A. They may simply read without moving from their desks, or, if they are willing, may come to the front of the class and accompany the reading with gestures.
3. After the dramatization, lead a discussion based on the questions following the script.
4. Repeat direction numbers 2 and 3 for the two other scripts.

Script A

MR. ABLE: I asked you to see me because your records indicate underachievement.

NEAL: Hey, look. I'm passing all my subjects.

MR. ABLE: We expect our students to relate to the academic standards of the school.

NEAL: Well, like I told you. I'm passing. I'm making it.

MR. ABLE: Neal, you're not "making it." Your tests reveal very high aptitude in verbal abilities.

NEAL: Yeah? I always knew I had the gift of rap.

MR. ABLE: But you've gotten C's in English! I want you to know that you should be living up to your true potential.

NEAL: That's right, I'm with the English. I owe it all to my English teacher, Mrs. Robinson. She's one tough lady.

MR. ABLE: Tough! Everyone knows that Mrs. Robinson is one of the easiest graders in the school!

Script A Points for Discussion

1. Ask students to identify the sources of confusion in Script A.

   ANSWER: Using undefined terms.

2. Discuss the difficulties which arise when a person uses jargon understandable only to a certain group of people.

3. Ask students to suggest statements or pose questions that could be used to clear up a conflict involving undefined terms.

   POSSIBLE QUESTIONS AND STATEMENTS: What exactly do you mean? Please use simpler words. Would you define your terms?

Script B

SEN. LEE: *The Alaskan pipeline is almost a reality. As much as I respect the views of the distinguished Senator here today, I must point out he would do better to discuss the future rather than the past.*

SEN. FOX: *I admire the intelligence of that suggestion, knowing--as we all do--that Senator Lee had to overcome the great handicap of a poor education. However, the future success of the Alaskan pipeline depends on our present actions. I suggest that we send observers immediately to judge the effects of the pipeline on the northern territories.*

SEN. LEE: *And one of those observers would certainly be Senator Fox, well-known outdoorsman and hunter. I wonder, sometimes, how a man can win fame as a hunter and at the same time fulfill the demands of government. Perhaps he combines the two.*

SEN. FOX: *I welcome your suggestion to have me be an observer. Unlike you, my humble friend, I can always find time and energy to answer the call of duty.*

Script B Points for Discussion

1. Ask students to identify the source of confusion.

   ANSWER: Insulting the opponent.

2. Discuss the methods of attack used in the script, pointing out that in certain situations opponents use polite tones and subtle insults. Students may offer examples from their own experience of having been reprimanded or attacked by a member of the family when guests were present.

3. Ask students to suggest clarification statements.

   POSSIBLE ANSWERS: Let's deal with the subject of the conflict and nothing else. The only way to settle this argument is to cut out all the insults.

Script C

MRS. GAY: Sandy, whether you like it or not, you are going to wash the dishes.

SANDY: You want me to do the dishes because you want me to help with the chores--right? I'll help, but I'll rake the leaves instead. Tommy can do the dishes.

MRS. GAY: Girls wash dishes. Boys do yard work. Look at yourself. It's not easy to tell you're a girl. Your brother's jeans, old shirt, scuffed sneakers. Don't you have any feminine pride?

SANDY: Clothes aren't important.

MRS. GAY: I knew you'd say that. Those lovely blouses I made you never come off their hangers. If only you'd dress nicely, you would be so pretty.

SANDY: I'm the one who wears my clothes. I don't see why it should bother you.

Script C Points for Discussion

1. Ask students to identify the source of confusion.

   ANSWER: Going off on a tangent.

2. Point out that tangents of the kind used in the script are very common, especially when one topic is closely related to another. Ask students to suggest common examples of tangents.

   POSSIBLE ANSWERS: Discussion of religion turning to discussion of personal ethics. Discussion of one person's decision or behavior turning to discussion of what everyone else does.

3. Ask students to suggest clarification statements.

   POSSIBLE ANSWERS: Let's stick to the main subject. We're going off on a tangent--let's get back to the first subject. Let's talk about one thing at a time.

III.5 WHEN THE CHEAPEST FOOD WAS THE BEST

OBJECTIVE: To have students follow a discovery illustrating the scientific thought processes of a medical researcher.

SUMMARY: The teacher reads an account describing research into the causes of beriberi. The account is divided into sections, with each section followed by questions for discussion.

MATERIALS: Research Account (follows).

TIME NEEDED: 20 to 30 minutes.

DIRECTIONS:

1. Read each section of the Research Account to the class.

2. Have students discuss and answer the questions which follow each section.

3. In Question 10, following Section 6, students are asked if Eijkman found the cause of beriberi. The account is written in such a way that it seems that white rice causes beriberi, when in fact the cause is a lack of vitamin B^1. If Eijkman's patients had a source of this vitamin other than the unpolished rice, they would not have become ill. Help the students to understand the difference between these two statements:

   a. Unpolished rice contains a vitamin which prevents beriberi.
   b. Polished rice causes beriberi.

4. Have students examine similar causal inferences:

   a. Hard work causes ulcers.
   b. Cigarettes cause cancer.
   c. Dogs cause rabies.

5. Ask whether students can name discoveries which were made by accident, by simple observation, or because of some small side effects. Think of Jenner overhearing a milkmaid saying that contact with cows (cowpox) made her immune to smallpox--an observation.

6. Discuss the concept of scientific research in general terms. Help the students to understand that scientists state hypotheses in order to clarify their own thinking and to make their research clear to others. Explain

that every hypothesis must be carefully tested so that other scientists can reach the same results and conclusions.

7. *Point out that scientists engaged in research may sometimes disregard factors which have no bearing on their original hypothesis.*

Research Account

SECTION 1

In 1889, Dr. Christian Eijkman (ik'-man) was director of the laboratories in a military hospital in the Dutch East Indies. For years he had been interested in beriberi, often called the "cannot" disease. It seems to result in a sort of paralysis of the legs and arms, and is often fatal. He had worked on a commission which investigated the disease and reported beriberi to be caused by an infection.

But Dr. Eijkman was not satisfied with the commission's report. No one had ever found the germ of beriberi. He himself had examined beriberi patients' blood, skin, and secretions--everything he could think of. But he could not find any germ.

One day, as Dr. Eijkman stood at the window of the hospital laboratory looking out into the yard, he noticed some chickens.

"Hmm," he said to himself. "There's something wrong with those chickens. Look how they wobble and stumble. And their wings and necks seem limp and droopy. I'll have to warn the cook not to kill any of those sick fowl for the table."

1. Why do you think Dr. Eijkman did not want the chickens fed to the patients?

SECTION 2

Christian Eijkman turned away from the window. But something bothered him. Those chickens reminded him of something. What was it? He turned back for another look.

2. What do you think the appearance of the chickens reminded the doctor of?

3. Do you think it would be enough for the doctor to say that since the chickens looked like the patients they all had the same disease?

4. Since the patients and the chickens appeared to have the same symptoms, could the doctor conclude that the same thing caused these symptoms?

SECTION 3

And then he had it: Those chickens had beriberi, the "cannot" disease!

Eijkman was jubilant. If chickens took the disease, here was a perfect experimental animal to work with. Perhaps he could really find the cause of beriberi at last.

Immediately he began to observe and experiment. He soon found that the chickens were fed the scraps of food from the hospital wards.

"Well, then," said Dr. Eijkman, "some germ must enter the body through food." And he began to examine the food that was served to his patients in the hospital.

5. *What do you think of Dr. Eijkman's hypothesis that germs entered the body through food, therefore, germs in the food caused the disease?*

6. *What piece of information led Dr. Eijkman to formulate this hypothesis?*

SECTION 4

As was customary in the Dutch East Indies, in common with most of the Orient, rice was the principal article of diet. Now, rice was sold in two forms: polished and unpolished. The form preferred by all of the natives was the more expensive white rice from which the husk had been removed and the skin polished away. But one could also get the cheaper brown rice, which had been husked but not polished. It still had its brown skin.

White rice was the form served in Eijkman's hospital. Carefully he examined this rice under the microscope, but did not find a germ that might cause beriberi. He observed and examined and dissected his beriberi chickens, but didn't find a germ with these methods, either.

7. *What could Dr. Eijkman conclude from these two pieces of information?*

SECTION 5

And then his experiments with chickens, from which he hoped to learn so much, were interrupted. A new superintendent of military hospitals came on a tour of inspection. Dutifully Eijkman did his share of showing the official around the hospital.

A boy was feeding the chickens as they passed through the yard. The superintendent stopped. "What is that you are giving the chickens, boy?"

The youngster held out the pan.

"White rice!" cried the superintendent indignantly. "White rice for chickens! What a waste of money! Dr. Eijkman, this must stop. Polished rice is too expensive to be wasted on chickens. They must have the cheap brown rice."

"But, sir," protested Eijkman. "These chickens are my experimental animals for the study of beriberi. From them I hope to learn how the disease is caused so that we can cure it. Think how much money we will save on medical treatment when we can wipe out beriberi. Why, our hospitals are crowded with it now! I must continue my experiments."

"Continue them with brown rice, then," said the superintendent.

"But it is important that the chickens have the same food as my patients. I'm convinced there is some connection between the disease and food."

Eijkman explained, argued, and pleaded. But it did no good. Nothing but brown rice was to be fed to the chickens.

Unwillingly, feeling that his months of experimentation were wasted, Eijkman gave in and fed the chickens brown rice. This meant the end of his work on beriberi, he thought.

But it was only the beginning. In a few weeks it struck him that his beriberi chickens looked better. They were less unsteady, less droopy, and they had definitely stopped dying! Could it be the new diet?

8. Why do you think that the chickens looked better? If you were Dr. Eijkman, would this new information have helped you to form a new hypothesis? What would it have been?

9. If you wanted to test the influence of the two different types of rice, what kind of experiment would you have set up? Would you have run your experiment on patients in the hospital or on chickens?

HERE IS WHAT DR. EIJKMAN DID. SEE IF YOU CAN FOLLOW THE STEPS OF HIS THINKING.

SECTION 6

To find out, he bought some polished rice and conducted a telling experiment. To one pen of chickens he fed white rice, with the skin polished off. To a second pen of fowls he fed unpolished rice, which still had its brown skin.

And thus Eijkman found the cause of beriberi: for the chickens in the first pen developed the "cannot" disease, while those in the second pen remained strong and healthy. The skin of the rice had some beriberi-preventing substance! He made the proof conclusive by feeding beriberi chickens rice-skins alone, and seeing them recover from the disease.

10. Did Dr. Eijkman find the cause of Beriberi or did his results really lead him to another conclusion?

SECTION 7

The next step was to try it on human beings. Dr. Eijkman ordered brown rice served to all patients. Then he had to see that he was obeyed, for the natives much preferred the polished white rice.

It worked with his patients exactly as it had with chickens: on the brown rice diet, all the beriberi sufferers began to improve. Eventually he had no patients with that disease!

Eijkman did not discover just what it is in the skin of the rice grain that prevents beriberi. Nor did any other research worker take up his work and carry it on. For nearly twenty years nothing more was done about accessory food factors.

At last, in 1906, Dr. Hopkins at Cambridge University performed some experiments which proved that there are such food factors which are vital to health and growth. In 1911, Casimir Funk named them vitamins.

Research account excerpted from:

THE STORY BEHIND GREAT MEDICAL DISCOVERIES
by Elizabeth Rider Montgomery. Dodd, Mead & Company, New York, 1945.

DIRECTIONS (continued):

7. Write "Interacting Factors" on the blackboard and make two columns under this heading. Label one column "positive" and the other "negative." Explain that an interacting factor can be internal (individual physical health) or external (amount of time spent in crowded places). Point out that an interacting factor does not cause a cold, but influences the number and severity of colds.

8. Have students suggest positive and negative interacting factors which have a definite relationship to the number and severity of colds. Here are some examples:
   Positive (likely to intensify suffering): poor health, malnutrition, exhaustion, stress situations.
   Negative (unlikely to intensify suffering): good health, balanced diet, regular hours.

9. Point out that there are some interacting factors which can be either positive or negative. A person frequently exposed to cold viruses in a crowded enclosed environment like a school, may have one cold after another. However, the symptoms are so slight that he or she does not suffer, but appears to be immune. Another person in the same environment may catch four or five severe colds in the same period of time.

10. Interacting factors can combine to increase the likelihood of contracting a cold. An example: A four-year-old child goes to the shopping mall with her mother and two days later has a severe cold. The single causal factor is exposure to a virus. The two interacting factors are the crowded, enclosed area and the age of the child. Preschoolers have little resistance to cold viruses and suffer more colds, often more severely than adults.

11. Point out that people catch the most severe colds when combined interacting factors are at work. Ask students to suggest such combinations.

12. If there is time, ask students how they think they could avoid catching a cold.

III.6 CATCHING A COLD

OBJECTIVE: To discuss cause and effect relationships.

SUMMARY: The teacher leads a discussion on the common cold and the relationship between exposure and suffering.

MATERIALS: Chalkboard and chalk; Information on the Common Cold (follows).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Ask students how many colds they have had during the current school year.

2. Ask how they think they caught the colds. Allow free discussion for a few minutes. Ask each student who caught a cold what he or she had in common with the others. Lead students to realize that there is only one cause of a cold--exposure to cold virus.

3. Write on the chalkboard: There is a single causal factor which results in catching a cold--exposure to cold virus.

4. Point out that with most diseases an exposed person subsequently becomes immune. Ask why this does not appear to be true for a cold.

   ANSWER: Over 50 major types of cold viruses are known and there are many more sub-types. Immunity to one does not give immunity to others.

5. Point out that the single factor recorded can thus be broken into more than 50 multiple factors. Record this on the chalkboard. Ask whether students think they could be exposed to more than one virus at a time. If so, what would the results be?

6. Ask why one person may suffer more than another and why one person may catch more colds than another. Allow a few minutes of free discussion.

Information on the Common Cold

1. Colds are caused by viruses. Current research indicates no other cause.

2. Standing in a draft, wearing wet clothes, or living in a cold house will not cause a person to catch a cold. Any one of those actions could be an interacting factor if the person were exposed to a cold virus. Even then, he or she may not catch a cold.

3. Explorers do not catch colds in the Arctic. When they return to a crowded city they catch severe colds. Groups of individuals in isolated areas having little outside contact with other people are exposed to fewer viruses than city dwellers, and, therefore, catch fewer colds.

4. The average American preschooler has six to twelve colds per year. Adults average three colds per year. Fifty percent of the population catch colds in the winter when more people spend more time together indoors. Twenty percent of the population catch colds in the summer.

5. Cold remedies relieve the symptoms of a cold but do not cure it. Large doses of vitamin C are believed by some scientists to help prevent colds.

III.7 SOCIAL ASSUMPTIONS

OBJECTIVE: To have students discuss common social assumptions, assess the reasoning behind such assumptions, and suggest alternative explanations.

SUMMARY: Students discuss social assumptions in groups and with the teacher. They evaluate possible reasons as to why each assumption is generally accepted and suggest other possible explanations, causes, or relationships.

MATERIALS: List of Social Assumptions, List of Alternative Explanations, Quiz Page (follow).

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Tell the students they are going to discuss social assumptions.

2. Define a social assumption as a statement which most people accept as true. A social assumption may or may not be based on the conclusions of tests and may or may not have a strong factual basis.

3. Point out that a social assumption might be based on fact, but many people accept the statement for incorrect reasons.

   EXAMPLE: Most scientists are men because men make better scientists.

4. Write the above example on the chalkboard. Ask students to suggest alternative explanations. They will have to accept as fact that in the United States most scientists are men. Briefly discuss any suggested explanations. Write some of them on the chalkboard.

   EXAMPLE: More boys than girls elect to take more science classes in school and college. Girls are encouraged to concentrate on other subjects. In general, both boys and girls believe that boys are more capable of scientific research than girls.

DIRECTIONS (continued):

5. Ask students to determine whether any of their suggestions explain why most scientists are men. Are these explanations multiple factors--each working separately--or are they interacting factors--each dependent upon the other. If they are interacting factors, at least two will be necessary to cause the result.

6. Point out that when a statement is made and a reason is given students should critically examine the validity of an alternative explanation.

7. At this point you may do one of two things:

   a. Divide the class into groups and have each group discuss the first three assumptions on the list (Facts and Causal Factors). Have them suggest at least one alternative explanation for each.

   OR

   b. Discuss each of the assumptions with the class and have students suggest explanations.

8. Even if you have students working in groups, stop discussion after a few minutes and discuss the explanations proposed by each group. (It is possible that some groups may not answer every question.)

9. Point out that some assumptions are based on a relationship which may or may not be a causal factor. Explain by asking the students to suggest the relationship between a hunter and the degree of his success. Point out that in ancient times it was believed that a lucky hunter would be successful, so rituals were devised to ensure his luck. It might be true that luck has a relationship to success, but good luck alone does not directly cause success.

10. Then discuss the final two assumptions (Facts and Relationships).

11. Check the alternative explanations suggested by each group against those given on the following page.

12. Announce that you will now give a quiz (teacher's copy follows). You will offer facts and a social assumption and ask for an alternative explanation. You will allow up to 15 seconds for group discussion on each question. The first group to offer a sensible explanation scores 10 points. If an explanation is not acceptable, the group loses five points and another group may try to answer the same question.

List of Social Assumptions

FACTS AND CAUSAL FACTORS

1. FACT: Children who grow up in the center of a city do not do as well in school as children in the suburbs.

   CAUSAL FACTOR: With poor housing, little opportunity to play, and high pollution, the city environment affects childrens' mental abilities.

2. FACT: Most traffic accidents happen within two miles of the driver's home.

   CAUSAL FACTOR: Drivers are careless on familiar roads.

3. FACT: The suicide rate is higher in large cities than in small towns or rural areas.

   CAUSAL FACTOR: People who live in rural areas are well-balanced; people who live in cities are disturbed.

FACTS AND RELATIONSHIPS

4. FACT: Since the 1960s, the average global temperature has dropped approximately two to seven degrees.

   CAUSAL FACTOR: Since the 1960s, more vehicles and factories have burnt more fuel, releasing dust particles into the air.

   CONCLUSION: The dust particles reflected the sun's heat, so the heat "bounced" away from earth.

5. FACT: Many professional basketball players are Black.

   CAUSAL FACTOR: A good basketball player is usually tall with long arms and legs and fast reactions.

   CONCLUSION: The best basketball players are Blacks because they have long arms and legs and fast reactions.

List of Alternative Explanations

One or two possible explanations are given for each example. Students may suggest other alternatives which may be just as probable.

1. Alternative explanations: Center city families spend less money on toys, books, and lessons than suburban families.

   Center city schools have fewer facilities and materials than suburban schools.

2. Alternative explanations: Drivers spend more time driving near their homes than on more distant roads. The laws of probability may, in part, explain the number of accidents.

3. Alternative explanations: City conditions such as noise, overcrowding, and competition cause the higher suicide rate.

   The pace and quality of life in rural areas are smoother and calmer than in the city.

4. Alternative explanations: There may be a relationship between climate and the eleven-year sunspot cycle.

   Changes in the angle of the earth's tilt could cause changes in climate.

5. Alternative explanations: There may be a relationship between job opportunities and the number of Blacks who try out for professional basketball teams.

   Perhaps more athletically talented non-Blacks choose to enter other professions.

Quiz Page

READ EACH PARAGRAPH AND ASK FOR AN ALTERNATIVE EXPLANATION.

1. It is a fact that up to 40% of all people released from prison commit other crimes and are reimprisoned within five years of their release. This is because criminals would rather break the law and chance another prison term than hold a job.

   Alternative Explanations:

   - A person in prison is seldom taught the skills necessary for becoming a responsible member of society. In fact, prison may have taught that person how to become a better criminal.

   - A person imprisoned once may have difficulty in earning his or her living honestly. He or she may resort to crime and be caught again.

2. It is a fact that a new low-income housing project in the suburbs often looks like a ghetto in a short time. This is because low-income people are dirty and lazy and don't take care of their homes.

   Alternative Explanations:

   - The new project may be badly designed or cheaply built and would deteriorate rapidly no matter who lived there.

   - The people may resent being placed in low-income housing and may avenge themselves on the buildings.

   - The people may lack the skills and money to care for their homes.

3. It is a fact that many men are poor housekeepers. This is because men do not have the ability to cook, clean, or do the laundry.

   Alternative Explanations:

   - Household skills take time to learn and men (and boys) spend their time learning other skills.

   - Men are taught to consider other activities more important than housekeeping.

4. A factory producing car batteries uses a lot of lead. Scientists know that children suffering from lead poisoning do not perform well in school. The mayor related these two facts and proposed a law forbidding school children to go near the factory.

Suggest an alternative explanation for either a large number of children getting low grades, or the same children suffering from lead poisoning.

Alternative Explanations:

- *The teacher or the teaching method was to blame for a large number of children getting low grades.*

- *The children contracted lead poisoning from automobile exhaust fumes.*

5. *Human beings and chimpanzees are primates and related in a number of ways. In chimpanzee troops, males take the lead. Because of the relationship between chimps and people it is natural and sensible to have men lead human society. Suggest an alternative explanation for the fact that most leaders in human society are men.*

Alternative Explanations:

- *There is a relationship between the past and the present. In the past, leaders were chosen for physical strength and men were often stronger than women.*

- *A leader needs certain skills which cannot be learned in the home. Many women stay home until their children are raised, giving them less chance to develop leadership skills.*

6. *The highest number of deaths caused by heart attacks occur in America. Americans eat a lot of foods containing cholesterol. We can conclude that cholesterol causes heart attacks.*

Alternative Explanations:

- *There may be a relationship between heart attacks and diet, but the diet alone usually does not cause heart attacks without interacting factors such as a lack of exercise or strain on the heart due to sudden, excessive activity.*

7. *Mononucleosis is called "the kissing disease" because it can be transmitted by kissing. Therefore, mononucleosis is caused by kissing.*

Alternative Explanations:

- *Teenagers and young adults are most susceptible to the germs that cause mono. During this same period of their lives, many young people are engaged in the pursuit of romance--which usually involves kissing. So mono and kissing occur during the same period of time.*

- A person gets mono by an interaction of exposure to the germs plus his or her own physical condition. Young people are often "rundown" because they are usually involved in many activities, including dating.

8. Auto mechanics earn a higher than average salary. This is because most customers don't know enough about cars to question the bills they receive.

   Alternative Explanations:

   - A year's salary may be above average because mechanics work long hours. Overtime rates may be charged because a customer needs his car repaired in a hurry.

   - Most people with special skills, such as mechanics, earn above the average hourly rate because of their knowledge and abilities.

   - The pay a worker receives for a service partly depends upon the necessity of and demand for that service. Most Americans depend on their cars. Most cars need repairs at some time. Therefore, auto mechanics are a necessity and are paid accordingly.

IV. CREATIVE THINKING

IV.1 WHAT IS AN ECOTECT?

OBJECTIVE: To describe possible future jobs.

SUMMARY: Job descriptions are developed for hypothetical future jobs.

MATERIALS: What's An Ecotect? (follows).

TIME NEEDED: 20 minutes.

DIRECTIONS:

1. Distribute What's An Ecotect? and ask students to make up job descriptions for 10 of them.
2. Ask volunteers to read their descriptions to the class.

POINTS FOR DISCUSSION:

1. Language Arts: Discuss what makes up a good description.
2. Social Studies & Family Living: Discuss life in the future.

What's an Ecotect?

Everyone knows what a chauffer is. And we're all familiar with gas station attendants. But 80 years ago, before the automobile became popular, these jobs and job titles did not exist.

See if you can describe some possible future jobs.

Select ten (10) job titles below. Make up a job description for each. Then make up four (4) job titles and descriptions on your own.

Biorhythm engineer	Sea herder	Mechbrain analyst	Risk rater
Green cross worker	Dictionary	Attendant watcher	Sono guide
Laser architect	Skysitter	Bionic therapist	Greenspace engineer
Experience agent	Host mother	Z-ray operator	Robo jockey
Leisure banker	Home spinner	Life-decision advisor	Future shock therapist
_____	_____	_____	_____
_____	_____	_____	_____

IV.2 INVENTIONS

OBJECTIVE: To demonstrate how inventors came up with new ideas.

SUMMARY: Students pretend they are inventors of everyday objects and relate how they thought of their ideas.

MATERIALS: How I Did It (follows).

TIME NEEDED: 20 minutes.

DIRECTIONS:

1. Distribute How I Did It handout. Ask students to fill in the blanks in Part I with the description of their inventions.
2. After two or three minutes, ask for volunteers to discuss their inventions .
3. Ask for volunteers to name the inventions. Allow for alternate descriptions/names.
4. Ask students to work on Part II in pairs.
5. After five to seven minutes, ask for volunteers to discuss ideas. Remember, there are no right answers.

POINTS FOR DISCUSSION:

1. What type of thinking does it take to be an inventor?
2. Discuss some famous inventions that changed our lives.

How I Did It

Part I

For each of the following exercises, pretend that you're a famous inventor. Fill in each of the blanks with the description of your famous idea. Name your famous idea as well.

1. You're the president of the Snooz-ese Alarm Clock Company. You can't find an alarm that will work--loud buzzers wake sleepers up but people hate the noise; soft noises are pleasant but don't wake people up.

   What I need is an alarm clock that will wake people with a _____

   _____

2. You're a health scientist for the Big Name Band-Aid Company. You're having difficulty inventing a band-aid that will cover and protect a cut from dirt and at the same time leave it open to the air so it can heal.

   What I need is to find a band-aid that is a _____

   _____

3. You're an inventor for the Sesame Door Company. Everyone's been coming to you with the same complaint. In the winter, when people go in and out, heat escapes from the building. In the summer, the open doors let the heat in and the cool air out.

   What I must do is to invent a door that is a _____

   _____

4. You're a famous security expert. A number of people from museums have come to you with a complaint. They want to guard priceless paintings from being touched and vandalized, but they don't want to put up a glass barrier and they can't afford to put a guard in every room.

   What these people need is a _____

   _____

Part II

Once again, pretend that you are that very famous inventor. FOR EACH INVENTION BELOW, NAME THE THING THAT GAVE YOU THE IDEA (animal, plant, geological formation, other human invention, etc.).

Mail carrier's bag	Coat pockets	Arrow
_____	_____	_____
Jackhammer	Radio antenna	Wood drill
_____	_____	_____
Vacuum cleaner	Pliers	Loom (for weaving)
_____	_____	_____
Photo-gray sunglasses	Water pic toothbrush	Aqualung
_____	_____	_____
Three-stage rocket	Ditch-digging machine	Envelope
_____	_____	_____

IV.3 USING MATERIALS CREATIVELY

OBJECTIVE: To break out of traditional patterns of use of materials in order to solve a problem.

SUMMARY: Problem is posed which necessitates the creative use of materials in order to reach a solution.

MATERIALS: Two String Problem and Solution Ideas (follow).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Project transparency or distribute handout of problem, and ask students to work individually, noting possible solutions.
2. After a few minutes, ask a volunteer to name the object(s) used in his or her solution. Determine how many students used the same object. If most students name the same object, allow a few minutes more for generation of alternative solutions.
3. Review the following solution ideas. You may wish to record them on the board. As you do so, encourage students to express their ideas clearly, stating the method, materials, and the new and different way in which an object was used.

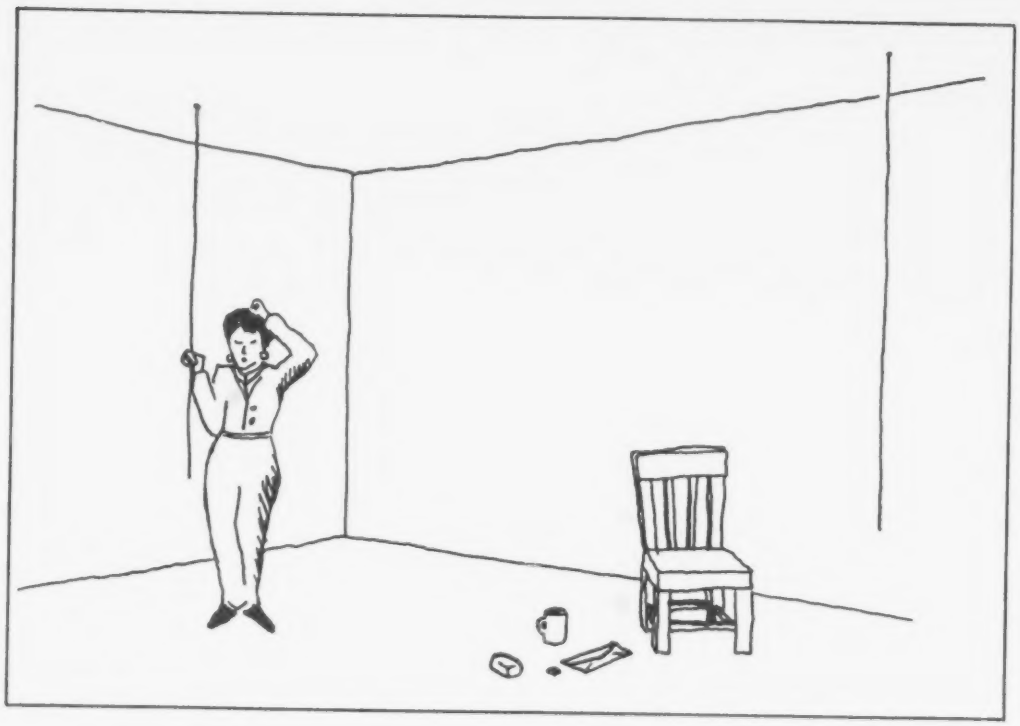
POINTS FOR DISCUSSION:

1. Discuss the following quote from the Nobel Prize winning physicist? Albert Azent-Gyorgyl:

   > Discovery consists of looking at the same thing as everyone else and thinking something different.

2. How does change encourage creative thinking?

Two Strings Problem



How can the woman tie the two strings together without removing the strings from the ceiling?

The strings are long enough to be tied together, but are so far apart that the woman cannot reach one string while holding on to the other.

The following objects are in the room:

- *a chair*
- *a postage stamp*
- *an envelope*
- *a cup of water*
- *a bar of soap*

Solution Ideas

Operative Word	Method	Materials and Use
Extension	Lengthen one string so that it will reach the other.	Envelope - tear it into a continuous strip. Stamp - used to join string to envelope.
Anchor	Join one string to chair at center. Bring second string to center.	Chair - used as anchor. Stamp - used to join string to chair.
Skyhook	Hold one string. Stand on chair. Fix string to ceiling as near to second string as possible. Tie strings together.	Chair - used as ladder. Stamp - used to stick string to ceiling (wet soap also could be a sticking agent).
Pendulum	Attach weight to string and set it swinging toward center. Hold other string and catch the first on forward swing.	Cup (empty) or soap - used as weight.

IV.4 NEW AND DIFFERENT THINKING

OBJECTIVES: To understand creative problem solving.

SUMMARY: Problem is posed which necessitates breaking out of traditional thinking patterns in order to reach a solution.

MATERIALS: Lost Ball Problem (follows).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Project transparency or distribute handout of problem and ask students to work individually, noting possible solutions. If students ask for additional information, tell them that the pipe is about 5 feet high, 3 inches in diameter, and that the ball is 2½ inches in diameter.

2. After two or three minutes, ask students to discuss the problem with a neighbor. If students seem frustrated, you may use the hints below:

   Hint One: Instead of trying to think of ways to reach the ball or ways to fish it out, how could you get the ball to come to you?

   Hint Two: When washing dishes by hand, how do you clean the bottom of glasses that are too tall and narrow to reach with a sponge?

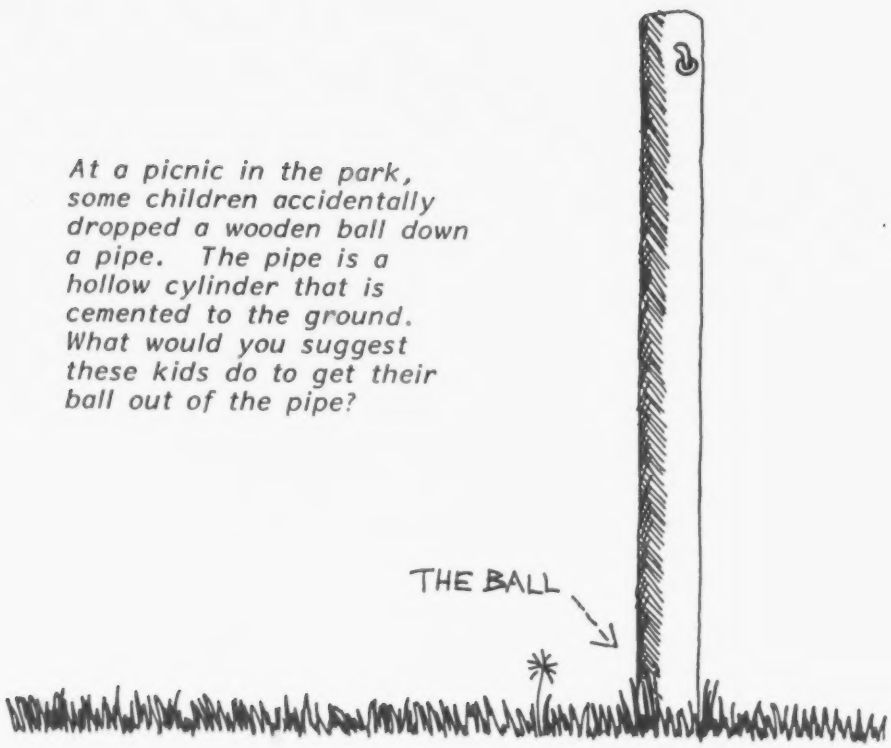
   Hint Three: How do pump sprays work? How do you get liquid detergent out of a bottle equipped with a pump spray?

3. Ask students for their ideas, and give solution. The problem is easily solved by pouring water into the pipe. (Students may suggest the use of two sticks - difficult, or bubble gum - the ball may be too heavy, or a vacuum cleaner - not available in a park.)

POINTS FOR DISCUSSION: Habit thinking suggests: "How do I get the ball out?" Creative thinking suggests a reversal: "How do I get the ball to come out by itself?" Looking at thinking from different angles or reversing situations is often helpful. Sometimes become so fixed in our thinking that we do not see solutions.

Lost Ball Problem

At a picnic in the park, some children accidentally dropped a wooden ball down a pipe. The pipe is a hollow cylinder that is cemented to the ground. What would you suggest these kids do to get their ball out of the pipe?



IV.5 WHAT IF....

OBJECTIVE: To have students realize the importance of historic events and scientific/mathematical laws.

SUMMARY: Class thinks of ways their lives would be different if an important event had not occurred or if a certain law were not true. (For example, if we had lost the Revolutionary War or if the law of gravity did not apply.)

MATERIALS: Chalkboard and chalk.

TIME NEEDED: 15-30 minutes.

DIRECTIONS:

1. Set the scene (choose year, planet, etc.) and announce the new (pretend) condition, fact, or situation.
2. Ask students to think of implications.
3. Have students share and discuss their implications with a neighbor.
4. Lead a group discussion and document major implications on the chalkboard.

POINTS FOR DISCUSSION:

1. How would your life be different?
2. What would you do differently?
3. Can we conclude that this condition, fact, or situation influences us in many ways?

V. PROBLEM SOLVING

V.1 DETECTIVES

OBJECTIVE: To introduce the concept of stating and testing an hypothesis.

SUMMARY: The teacher makes statements using a code. Students attempt to break the code by making similar statements. Once they understand the rules, students make codes of their own.

MATERIALS: List of Codes (follows).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Tell the students something like this: "I'm a code expert and you're detectives. I'll say things in code. When you think you know what the code is, you can try using the same code. I'm honest and I'll tell you if you're right or wrong."

2. Make statements in code, one statement at a time. For instance, suppose your code is state capitals east of the Mississippi. You might say: "I'm going to Nashville" or "Trenton is one of my favorite cities" or "I like Harrisburg but I don't like Denver."

3. Any student who raises his or her hand and correctly makes a statement using your code, may join you in offering statements to the class. If that student subsequently offers an incorrect statement, say that it is wrong and make a new statement in its place.

4. Continue until four or five students have broken your code. Then ask one of them to tell the class what the code is. Point out that when a student thought he or she knew the code, that student was making an hypothesis--a guess based on the facts you had presented. When a student made a statement in code, he or she was testing the hypothesis.

5. Play the game again using another code. Or, have the students volunteer to lead the game using their own codes.

POINTS FOR DISCUSSION:

1. Ask students who broke the code to tell the class how they did it. (Reinforce the idea of forming and testing an hypothesis.)

2. Show how other problem solving activities include hypothesis testing.

List of Codes

NOTE TO TEACHER: Choose code groups in ascending order of difficulty.

1. Words which contain the sound "ff" regardless of spelling:

roughness	physics	difficult
dolphin	puff	enough

2. Fruits and/or vegetables which contain double letters:

strawberry	mushroom	zucchini	pepper
eggplant	scallion	currant	apple
cabbage	lettuce	carrot	
cherry	beet	broccoli	

3. Numbers under 100 divisible only by 1 and by themselves:

   1, 3, 5, 7, 11, 13, 17, 19, 23, 29, 37, 41, etc.

4. Statements that include a proper noun must end in a word with an "ing" suffix:

   "Clare was dancing." "The Colorado River is dying."

5. First letters of the months of the year:

   J F M A M J J A S O N D used as the first letter of a statement.

   "Jane went to bed."

   "Frank went to the store."

   "Mary watched TV."

V.2 SABOTAGE

OBJECTIVE: To identify and overcome sources of confusion deliberately introduced into a discussion.

SUMMARY: Four students are secretly primed to introduce confusion into a discussion. These four students are the "wreckers" in this activity. The class openly discusses and must agree on a decoration for the school hall. They must identify the "wreckers" and their techniques while continuing the discussion.

MATERIALS: None.

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Before the lesson begins, choose four able and self-confident students to be "wreckers" and give them the following directions:

   a. During the class discussion each of the four is to participate with the intention of increasing conflict.

   b. Assign each of the four a different source of confusion: going off on a tangent, using undefined terms, using emotional language, and attacking the opponent (without using personal insults).

   c. When any one "wrecker" is identified, he or she must stop using the negative technique. The "wreckers" must use their techniques in a realistic, unobvious manner to prevent easy detection.

2. Begin the lesson by telling all students that they are going to discuss and resolve an hypothetical problem.

3. Tell them that during the discussion they will set their own values and should be prepared to consider compromises.

4. Describe the problem situation: Truman School has a new building. The principal wants some form of art work in the entry hall. She insists on the following:

   a. Some part of the art work should be permanent.

DIRECTIONS (continued):

b. Some bright colors should be used.

c. The spirit of the school should be shown in some way.

5. If students are slow in making suggestions, ask any of the following questions: Can we use students' art work? What kinds of art exist and which could be used? How about a mural? Mobile? Sculpture? Crafts?

6. Allow the students as much freedom as possible. They may brainstorm ideas, make lists, vote on decisions, and compromise in any way they like.

7. As the "wreckers" gradually join the discussion, conflict will increase. After no more than 10 minutes (set time at your own discretion) tell the class that four students have been told to use certain sources of confusion in order to increase conflict. List the four sources of confusion on the blackboard, but do not identify the "wreckers." Tell the class that once a "wrecker" and his or her technique has been correctly identified, that student will stop using the technique.

8. Continue the discussion, reminding the students that they now face a double challenge: to reach agreement on the decoration for Truman School and to identify the "wreckers" and their sources of confusion. Point out that the sooner they complete identification, the sooner they are likely to agree on the decoration.

9. Continue the activity until agreement has been reached. It is possible that the class will reach agreement without identifying all of the "wreckers." If that happens, unidentified "wreckers" may identify themselves.

POINTS FOR DISCUSSION:

1. Which source of confusion was the most obvious?

2. Which was the least obvious?

3. Which source of confusion was the most disruptive?

4. Which do you think is most commonly used in everyday conflicts?

V.3 PROBLEM POSING

OBJECTIVE: To discover how math problems are common and why it is important to learn to solve them.

SUMMARY: Students are shown a picture and asked to "discover" a mathematical problem in the picture.

MATERIALS: Picture of a common scene from magazine or textbook.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Show students a picture of a common scene such as a person looking at a clock, painting a house, making a purchase, etc.
2. Ask students to write a mathematical problem about the events depicted in the picture.
3. Have students exchange papers and try to solve their neighbor's problem.

POINTS FOR DISCUSSION:

1. Are there objects or events which do not have a quantitative or mathematical dimension?
2. How often does the average person encounter situations which require problem solving?

V.4 JUMPING TO CONCLUSIONS AND ASSUMPTIONS

OBJECTIVE: To illustrate that a limited viewpoint or perspective when observing things can lead to false conclusions. To illustrate that judgments made in the absence of data or on the basis of assumptions can be false.

SUMMARY: Students are given untitled "droodles" and asked to guess what the drawings depict. The artist's titles are then given and compared to the class' guesses.

MATERIALS: "Droodles" sheet (follows).

TIME NEEDED: 15 minutes.

DIRECTIONS:

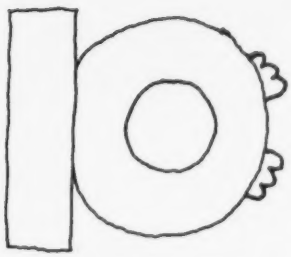
1. Have students write what they think each "droodle" is.
2. Discuss what each person assumed the "droodles" to be. Your copy of "droodles" sheet (following) indicates what the artist had in mind when he drew them.

POINTS FOR DISCUSSION:

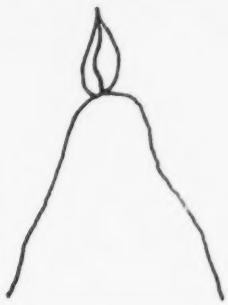
1. Did the class guess many of the "droodles" correctly?
2. Why are "droodles" so hard to figure out?
3. If these "droodles" were photographs, what questions would you need to ask the photographer before you judged what was going on? (A possible response to this question is that the perspective or viewpoint of the photographer should be questioned in order to identify or to judge the photograph.)
4. How is guessing about "droodles" like jumping to a conclusion or making an unwarranted assumption?

"DROODLES"

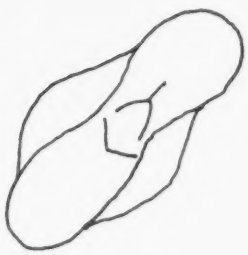
JUMPING TO CONCLUSIONS AND ASSUMPTIONS



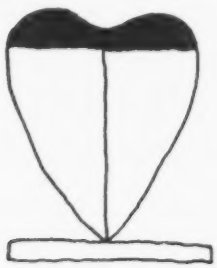
1. A bird's eye view of a Mexican resting against a wall.



2. An Indian hiding behind an ant hill.

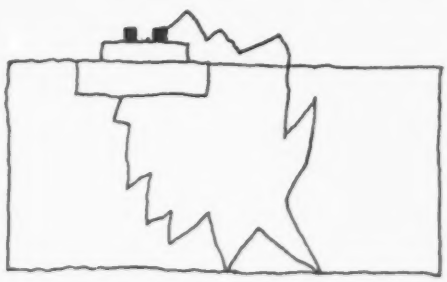


3. A duck yawning.



4. A fat lady doing a jacknife dive as seen from the rear.

5. An umbrella after a wind storm.



6. An ocean liner sailing past an iceberg.

V.5 PUZZLING PROBLEMS

OBJECTIVE: To have students solve puzzles using the process of deduction.

SUMMARY: Students work individually to solve three puzzle problems as quickly as possible. Their answers and methods are discussed.

MATERIALS: Puzzling Problems (follow).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Tell the students they are to work individually to solve puzzles. They may use any method they like but should work as quickly as possible.

2. Tell the students to try to solve Puzzle A. As soon as someone has solved the problem, he or she should raise his or her hand.

3. When at least 10 students have solved Puzzle A, discuss the answer to the puzzle and ask students to describe their methods for finding the solution. Ask them if they used pencil and paper, if they used objects--pretending each was a part of the puzzle, or if they visualized the situation.

4. Have the students go on to the second and third puzzles. Allow most of the students to find these solutions before discussing them.

Puzzling Problems

PUZZLE A

Mr. Black, Mr. Green, and Mr. Brown arrived at the restaurant at the same time. One was wearing a black tie. Another was wearing a green tie. The third was wearing a brown tie.

As they sat down to eat, the man wearing the green tie smiled. "Why are you smiling?" asked Mr. Black. "Look at the colors of our ties," he answered. "Each color is the same as one of our last names. But no one is wearing a tie that matches his own name."

WHAT WAS THE COLOR OF THE TIE THAT EACH MAN WAS WEARING?

ANSWER: Mr. Black spoke to the man wearing a green tie, therefore he is not wearing green nor black. Mr. Black must be wearing the brown tie. Mr. Green is wearing the black tie. Mr. Brown is wearing the green tie.

PUZZLE B

Joan needs a pair of ski socks and knows that there are six pair in a box in the attic, all her size.

"They are all white," said her mother. "But two pair have red borders, two pair green borders and two pair blue borders. Make sure you get a matching pair."

The attic is completely dark so Joan can't see the colors of the borders.

HOW MANY SOCKS MUST SHE TAKE OUT OF THE BOX BEFORE SHE CAN BE SURE THAT SHE HAS ONE MATCHING PAIR?

ANSWER: Four. If the first three socks are all different, the fourth sock must match one of the first three. Only by luck would she have a matching pair by taking out less than four socks.

PUZZLE C

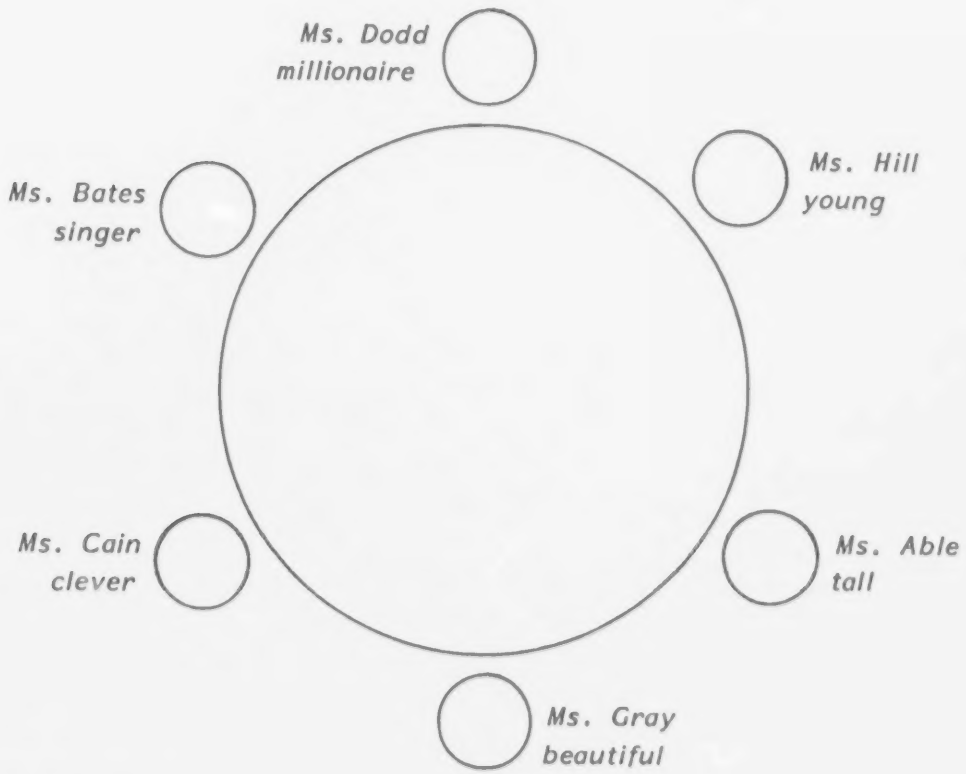
Six women sat around a circular table. Their names were Ms. Able, Ms. Bates, Ms. Cain, Ms. Dodd, Ms. Gray and Ms. Hill.

One woman was very young, one was clever, one was tall, one was beautiful, one was a millionaire, and one was a singer.

The millionaire sat directly opposite Ms. Gray. The woman who was tall sat opposite Ms. Bates, who sat between the clever woman and the millionaire. The young woman sat opposite Ms. Cain, next to the tall woman and to the left of the millionaire. Ms. Able sat to the left of the young woman and opposite singer. Ms. Hill sat opposite Ms Cain.

IDENTIFY EACH OF THESE WOMEN BY NAME AND DESCRIPTION.

ANSWER: Ms. Able is tall. Ms. Bates is the singer. Ms. Cain is clever. Ms. Dodd is a millionaire. Ms. Gray is beautiful. Ms. Hill is young.



V.6 STATIC ELECTRICITY

OBJECTIVE: To have students observe and conduct a series of tests to discover which factors influence the results.

SUMMARY: Students work in groups to conduct a series of tests to discover which factors influence the effectiveness of static electricity charges and discharges. They test an hypothesis given by the teacher.

MATERIALS: Tissue paper. Woolen, nylon, or silk fabric. A glass rod, plastic combs, and pens to be used as insulators. Chalkboard and chalk.

TIME NEEDED: 20 to 30 minutes.

DIRECTIONS:

1. Tear a piece of tissue paper about 2 inches square into about 30 tiny bits. Put the bits of paper on a book.

2. Rub a glass rod over a piece of nylon, woolen, or silk fabric.

3. Hold the rod over the book and lower it slowly toward the bits of paper. (Make sure that all the students can see.) The bits of paper will jump onto the rod. Some pieces may immediately fly off.

4. Ask the students to describe your actions and to name the cause of the jumping paper.

5. Ask students to describe briefly their own experiences with static electricity. Tell them the glass rod is an insulator and ask if they can name other objects or materials which are good insulators.

   ANSWER: hard plastic or rubber found in items like combs, quartz, amber, sealing wax, and certain kinds of shoe soles.

6. Divide the class into pairs or small groups. Give each group a piece of tissue paper to be torn into tiny bits. Make sure that each group has a comb or other insulator.

7. Tell the students that they are going to conduct a series of tests by running insulators through their hair and picking up bits of paper. They are to find out whether

DIRECTIONS (continued):

their results are influenced by the ways in which they conduct the tests.

8. Write on the chalkboard:

Treatment Factors	Measurement Differences
Comb - material	Paper - size of bits
length of comb	weight of bits
length of teeth	amount of handling
concentration of teeth	Action - distance of comb from paper
Hair - texture	accumulation of charge
length	
oil content	
Action - number of strokes	
strength of strokes	
time spent stroking	

9. Tell the students that for each test they should notice the number of bits of paper picked up.

10. Discuss and explain the lists on the chalkboard. Students may choose any combination of treatment factors on which to base their tests. Here are some examples:

    a. One comb used on one person with actions varied.
    b. Two combs used on one person with one action.
    c. One comb used on various people with one action.

    They should make sure that the variations on a test are all measured in the same way. They may refer to the chalkboard list in order to control measurement differences.

11. Allow students at least five minutes to conduct tests based on the chalkboard lists.

12. Discuss results with the class. Ask each group to describe a test in which the highest number of bits of paper was picked up. Ask students to describe a test with poor results. Ask if they can suggest what would happen if the comb was wet.

13. Write on the chalkboard -

    Hypothesis: A plastic pen will pick up more bits of paper if it is rubbed for 30 seconds on silk or nylon than if it is rubbed for 30 seconds on any other fabric.

14. Have each group test this hypothesis and report results to the class. List the fabrics used by each group.

15. Point out that all scientific tests must be conducted very carefully so that treatment and methods of measurement are properly controlled.

TEACHER NOTE: The results of the tests conducted in this activity will be influenced by the amount of humidity in the classroom. Static electricity is more easily recorded in a dry atmosphere than in humid or damp conditions. If the bits of paper are handled frequently they become oily and will no longer jump onto a comb. Also, if a comb has sharply pointed teeth, it will conduct static electricity less readily than a comb with dull or rounded teeth.

V.7 PAPER PLANES

OBJECTIVE: To discover and attempt to control all causal factors in designing a test for paper airplanes.

SUMMARY: Four paper airplanes are tested to compare efficiency of design. Students determine test method and evaluate results.

MATERIALS: Paper, scissors, glue, tape, chalkboard, chalk.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Tell the students they are going to test four paper airplanes.
2. Give each of four volunteers an identical sheet of paper and ask them to make paper planes.
3. As they are doing this, draw the following chart on the chalkboard.

	Plane A	Plane B	Plane C	Plane D
Distance				
Flight Curve				

4. Have students determine a starting point for the "take off" and nominate a referee to record distance from take off to landing. You don't need to measure exact distance, but may simply mark each of the four landing places.
5. Have students suggest a means of judging flight curve. A simple possibility is to judge the curve on a scale of 1 to 10, with students voting on the score.
6. Have the plane designers test their planes. Record results.
7. Ask students if they are satisfied with the test and are ready to draw a conclusion.
8. Have students name factors which were not controlled. Suggest ways in which these factors could be controlled.
9. Run another flight test and record the results.

DIRECTIONS (continued):

10. Continue in this manner--test flight and discussion--until students are satisfied that they have conclusive results based on a fair test. Here are some causal factors which students may want to control:

    a. height of take off point
    b. amount of take off thrust
    c. angle and direction of take off
    d. possibility of favoritism influencing scores given for flight curve
    e. possibility of one plane making one perfect flight which cannot be repeated
    f. drafts
    g. obstacles

POINTS FOR DISCUSSION:

1. Review procedure followed.

2. Discuss cause and effect.

3. Relate activities to jobs in the "real world."

V.8 MEMORY

OBJECTIVE: To have students design and take part in a test.

SUMMARY: Students discuss and design a test comparing three methods of memorization. They take part in the test and evaluate results.

MATERIALS: Chalkboard and chalk, Spelling Words (follows). Association Study Method (follows). Reproductions of these instructions are necessary for this activity.

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Ask the students what they consider to be the best way to memorize words for a spelling test. Allow a few minutes of free discussion.

2. Tell the students that there is a method called "association" that you would like to test against two kinds of individual study methods. The test will be carried out during this activity period.

3. Have the class divide themselves into three study groups. Group A will use "association." Group B will write the words on scrap paper as many times as possible. Group C will repeat the spelling of each word silently.

4. Introduce students to the rules of test design and write them on the chalkboard:

    a. Control all possible causal factors.
    b. Control the time factor.
    c. Control for differences in the groups.
    d. Make sure all participants are measured in the same way.
    e. Conclusions should follow from the results of the tests.

5. Begin with the third rule. Have students decide how to set up the three groups. (Names on slips of paper pulled out of a hat is one fair system.) Tell students to remember whether they belong to Group A, Group B, or Group C.

DIRECTIONS (continued):

6. Ask students to name causal factors that should be controlled and tell how to control them. Remind them that you are testing three methods of learning a list of correctly spelled words. Help students to control factors in a way similar to this:

   a. All students learn the same list of words.
   b. All students are tested in the same way. The teacher reads the words aloud and has all students try to write them correctly.
   c. Each group uses only the method given.

7. Students will probably want to know what words they are to learn. Tell them that you have a suitable list of 10 words.

8. Have students decide how to control for time. All groups should spend the same amount of time, three to five minutes, memorizing the words listed. All groups should study at the same time.

9. Have students decide how the work will be corrected (students could trade papers) and how results will be recorded (in three columns on the chalkboard, with each column averaged).

10. Have students in Groups B and C sit at one side of the room and allow them to discuss the study methods they are to use.

11. Have students in Group A sit together at the other side of the room. Reproduce copies of the Association Study Method page and give them to members of Group A.

12. Give students the Spelling List. Allow the study time agreed upon (three to five minutes).

13. Stop all the students together. Collect spelling lists. Collect instructions from Group A. Call each word on the list once. Have students write the words.

14. Have students correct the words, assigning 1-10. Record and average results for each group.

15. Discuss the results and draw a conclusion about which method was better for the spelling list.

POINTS FOR DISCUSSION:

1. Ask students how they plan to study for their next spelling or vocabulary test.

2. Discuss how to develop word associations.

Spelling Words

Learn the spelling of each word by using the method assigned to your group.

CANTANKEROUS

DILEMMA

EXHORBITANT

CRESCENT

FORGETTABLE

PHOENIX

BROOCH

CATACOMB

TWELFTH

SUBTLE

Association Study Method

Learn the spelling of each word by memorizing the word and its association.

CANTANKEROUS - - ER - OUS

DILEMMA POOR

IN A DIL - emma

EXHORBITANT

-

-

CRESCENT CRES -

FORGETTABLE FORGE *the* ABLE

PHOENIX P -

- NIX

BROOCH BR - - CH

CATACOMB - A -

TWELFTH This is the tw - ELF - th elf.

SUBTLE - TLE

V.9 PERFORMING TESTS

OBJECTIVE: To have students perform tests, record results and draw conclusions.

SUMMARY: The class is divided into two teams, each with a leader. The leader of each team is given a description of a test and the team administers the test, records the results, and draws conclusions. Class discussion follows.

MATERIALS: Reaction Test and Endurance Test (follow). One ruler, one watch with a second hand, pencil, and paper.

TIME NEEDED: 30 minutes.

DIRECTIONS:

1. Tell the students that they are going to administer and take tests. Make sure every student has a pencil and paper.

2. Divide the class in half with an equal number of girls and boys on each team. Have one team read the instructions for the Reaction Test. The other group reads the Endurance Test instructions.

3. Choose a leader for each team. Give each leader a copy of one test description. Allow about 3 minutes for each leader to organize the members of his or her team.

4. As far as possible, allow the students to conduct the tests without your help.

5. Run the Reaction Test, and then run the Endurance Test.

6. Tell both teams to set the results aside for a few minutes.

7. Tell the students that both sets of instructions were fair, but not detailed. Discuss the following questions:

   a. In the Reaction Test, which factor in administering the test could have varied from subject to subject and thus influenced the results?

DIRECTIONS (continued):

ANSWER: The position and height of the ruler before it was dropped, the speed at which the leader counted "1, 2, 3" and the length of time between the word "three" and the action of releasing the ruler.

b. In the Endurance Test the instructions stated that each subject was to hold a book flat on his or her palm. Did all subjects hold exactly the same kind of book in the same way? If not, the test was unfair.

c. The observers were asked to record the time at which a subject lowered his or her arm. Did all observers agree on the meaning of this part of the instructions? If a subject simply flexed his/her fingers or changed the angle of his/her body, was he/she allowed to continue? Unless all observers agreed to and followed the same standards, the test was unfair.

d. In the Endurance Test, why did the arm muscles tire or begin to ache?

ANSWER: The arm muscles were using up oxygen and producing wastes. As the subject was sitting still the total amount of oxygen needed by the body increased only very slightly. The slight increase was not enough to make the subject breathe or pant. So, there was no increased oxygen supply to the arm to help speed up the removal of waste products.

e. Without moving the arm, how could the subject make the muscles feel less tired?

ANSWER: By increasing the amount of oxygen, by taking deep breaths quickly.

f. Did any subject change his or her breathing during the Endurance Test? If so, the test was unfair.

8. Have students record the average scores of the tests and announce conclusions.

9. Ask if each team is satisfied with its conclusions after considering the points just discussed.

10. Have students suggest ways to test endurance that would allow all factors to be controlled.

Endurance Test

If you pick up a 200 pound weight you demonstrate strength. If you carry a 50 pound weight for 24 hours you demonstrate endurance.

YOUR HYPOTHESIS: Girls have more endurance than boys.

TEST METHOD: The other half of the class are your subjects. The girls make up Group A. The boys make up Group B. When the teacher tells you to begin, show your subjects what they are to do by giving a demonstration.

1. *Assign each member of your team to stand next to the desk of one member on the other team. Your team member must watch his or her subject and record the time when the subject's endurance falters.*

2. *Tell your subjects to sit at their desks, holding their left arms in front of them at shoulder height, level with their desk tops. Place a book flat on each subject's left palm. At the same time, all must silently tap their thighs with their right hands.*

3. *Make sure all subjects begin together. Keep your eye on the clock and call out every 5 seconds, like this: 5 seconds, 10 seconds, 15 seconds, etc.*

4. *Each member of your team writes the time when his or her subject lowers his or her left hand.*

5. *Continue until all subjects have lowered their hands.*

6. *Add up all the girls' endurance times and divide by the number of girls who were subjects. Do the same with the boys' endurance times. This will give you two average times.*

7. *Discuss the results with your team. Draw a conclusion and announce it to the class.*

Reaction Test

If you see a rock flying toward you, you duck. The speed with which you avoid the rock is called reaction time.

YOUR HYPOTHESIS: Boys react faster than girls.

TEST METHOD: The other half of the class are your subjects. The girls make up Group A. The boys make up Group B. When the teacher tells you to begin, show your subjects what they are to do by giving a demonstration.

1. The leader of your team takes a 12" ruler.
2. Another member of your team has a pencil and paper to record results.
3. Ask a subject to stand up, holding his or her hands 4" apart, palms facing, fingers horizontal.
4. Hold the ruler between and above the subject's hands so that the number 12 is at the top and the bottom edge of the ruler is level with the top of the subject's fingers.
5. Count "1, 2, 3" and drop the ruler straight down. The subject will catch the ruler between his or her hands.
6. Note the number on the ruler that shows above the top of the subject's hand.
7. Have your recorder write that number in the column headed "boys" or "girls"--whichever the subject is.
8. Continue until you have tested every subject.
9. Have the recorder add up the total scores for girls and boys. Divide each total by the number of subjects in that group. This will give you an average score for boys and an average score for girls.
10. Discuss the results with your team. Draw a conclusion and announce it to the class.

V.10 HOW HIGH?

OBJECTIVE: To determine (1) the influence of suggestion on a test of muscular reaction, and (2) the influence of individual variations in physical build and muscular reaction.

SUMMARY: Three groups, each made up of three students, are given different instructions for taking a test to measure arm muscle reactions. Each group's instructions include a prediction of reaction results. The first group is told standard results, the second group is given an overestimation of results, and the third group is told an underestimation of results.

MATERIALS: Yardstick or tape measure, watch with second hand, pencil, chalkboard and chalk, doorjamb, doorway to classroom or closet.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Tell students that you want nine volunteers for a test measuring arm muscle reactions.

2. Choose nine students. Have six students go to another part of the building where they will not see or hear the test in progress.

3. Ask for three classroom volunteers. One volunteer will indicate the height of the subjects' arms by making a pencil mark on the doorjamb at the tip of the right thumb before and after the 30-second period. The second volunteer will time the 30-second intervals, telling each subject when to start and stop pressing. The third volunteer will measure and record on paper the distance from pencil mark to floor.

4. Read the following test instructions to the first three students:

   We are going to test how your arm muscles react after you have tensed them for a certain period of time. I will ask each of you to stand in the doorway with your arms at your sides, at thigh level. You will place the back of your hands against the doorjamb and press against it as hard as you can for about 30 seconds. Then you will step away from the doorjamb and try to relax your arms. You will notice that as you relax

DIRECTIONS (continued):

your arms, they begin to rise. Before the experiment we will mark the height of your thumb from the floor when it is placed flat in the doorjamb. After your arms have risen, we will again make a mark on the doorjamb showing the height of your thumb from the floor.

5. Read the following closing statement to the first group of students only.

   Our hypothesis is this: Pressing against the doorjamb causes your arm muscles to contract. When the arm muscle is allowed to relax, the arm reacts by rising. Usually, the arm will rise to above waist level.

6. Perform the experiment on the first group of students. After the results have been recorded, explain to the class how the directions will be altered for the next two groups. Emphasize that it is important that the students being tested receive no feedback or supplemental instruction from the class.

7. Repeat the first part of the directions for the second group. Close with this statement:

   Our hypothesis is: Pressing against the doorjamb causes your arm muscles to contract. When the arm muscle is allowed to relax, the arm reacts by rising. Usually, the arm will rise to about shoulder level.

8. Perform the experiment on the second group. Then, call the third group of students into the classroom. Repeat the first part of the directions and close with this statement:

   Our hypothesis is this: Pressing against the doorjamb causes the arm muscles to contract. When the arm muscle is allowed to relax, the arm reacts by rising. Usually, the arm will rise only about three inches.

9. Have the recorder copy all test results onto the blackboard.

10. Discuss the test and results, asking the following questions:

    a. Do the test results show that the subjects were influenced by which of the hypotheses they were told?

DIRECTIONS (continued):

b. Is there any indication that the reaction of the first person tested in each group influenced the results of the next two members' tests?

c. What is the major factor which cannot be controlled with this test method?

ANSWER: The amount of pressure exerted by a subject.

d. What factors or differences between individual subjects could influence results?

ANSWERS: If a subject talks during the test, or breathes in pants, he or she supplies additional oxygen to the muscles. The reaction will be smaller. A subject who exercises his or her arm muscles regularly is likely to have a smaller reaction. A subject who shifts his or her body during the test may relieve the amount of pressure exerted by one or both arms and thus have a smaller reaction.

V.11 PROBLEM FINDING

OBJECTIVE: To have students think about types of math problems and practice verifying answers.

SUMMARY: Students work backwards to write a problem for a given answer.

MATERIALS: Chalkboard and chalk.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Write several numbers on the board specifying the object.

   For example: 108 oranges
   1,228 miles
   58 dogs

2. Ask the class to make up word problems which have these answers.

3. Have students read their problems and solve them on the board.

4. Poll the class to determine the different types of operations used.

POINTS FOR DISCUSSION:

1. Ask students how they went about thinking up their problems.

2. Discuss the usefulness in checking answers by working problems backwards.

V.12 BRAINSTORMING SOLUTIONS

OBJECTIVE: To introduce "brainstorming" as a method of generating ideas.

SUMMARY: Students work in groups to brainstorm solutions for one or two given conflict situations.

MATERIALS: Two Problems (follow).

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Divide class into four or five groups.
2. Tell the class that they are going to use a special method of getting new ideas called "brainstorming." A brainstorm is a sudden, bright idea. Each group will come up with as many brainstorms as possible.
3. Instruct the groups to take the following steps:
   a. Read the first problem.
   b. Appoint one person to act as a recorder, writing down all ideas.
   c. Everyone in the group must come up with as many ideas as possible to help discover ghe best solution.
   d. The ideas must be offered quickly, as soon as they come to mind.
   e. Ideas can be wild or unlikely, the more imaginative the better.
   f. No one may criticize any idea for any reason.
4. After about five minutes of suggesting ideas, the group should read the ideas offered and discuss which ones can be adapted or combined into the most successful solution.
5. The group then offers their most successful solution to the class and explains why they think it would be most successful. They also may offer their "wildest" idea and/or the total number of ideas the group produced.

6. *If there is time and inclination, the second and more difficult problem may be "brainstormed."*

POINTS FOR DISCUSSION:

1. *When is "brainstorming" a good idea?*
2. *When would "brainstorming" be a waste of time?*

Two Problems

PROBLEM #1

There is a vacant lot in the middle of Bay City that the city council has decided to turn into a playground/recreation area. The lot is a little larger than a basketball court and contains two trees. Three groups of people want the lot for their own purposes: elementary school children, teenagers, and retired people. The elementary school children want a lot to play in after school but don't want the ordinary swings, slides, and jungle gyms that are found in school playgrounds. Teenagers want a place for some physical activity and to meet with their friends. The older people want the lot as a place to sit in the daytime and talk with neighbors.

What are some solutions for designing the playground?

PROBLEM #2

The library of Teeneck High School is closed while discussion continues about books on the shelves and books to be ordered. The school principal says that he and the teachers have the right to choose library books. Some of the parents say that students should be allowed to read anything they choose and should have a very wide choice of books. Another viewpoint is held by a community group who wants to get rid of all books which mention sex, drugs, or alcoholic beverages.

Can you come up with some solutions?

VI. DECISION-MAKING

VI.1 PRESSURE ON THE WITNESS

OBJECTIVE: To demonstrate the power of persuasion by a large group over a small group.

SUMMARY: Seven students measure two lines to determine whether they are the same length. Although the lines are unequal, five of the students insist, as they have secretly been instructed, that the lines are equal and attempt to persuade the other two students that this is true.

MATERIALS: Poster Sample (follows) and seven rulers.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. Before class, secretly arrange with five students to assist you with this demonstration. Explain the experiment and tell them to insist, when asked, that the lines they measure are of equal length. Make certain that the rest of the class does not know you have spoken to these students.

2. Announce to the class that you wish to see if they know how to use a ruler properly.

3. Select seven students for this test, including the five students with whom you have arranged the experiment.

4. Have each student measure both lines, but not give an answer until all seven have finished.

5. First, ask the two students with whom you have made no arrangements whether or not the lines are of equal length. These students should say "No" since the lines are of unequal length. Then ask the five pre-selected students. They will answer (incorrectly), "Yes."

6. Express some surprise that there is disagreement and ask the students to measure the lines again and give their answers. This time call first on those students with whom you have made prior arrangements. They again will answer incorrectly, "Yes." How do the students with whom you have made no arrangements answer?

DIRECTIONS (continued):

a. If either or both answer "No," go around one or two more times to see if either or both will eventually conform to the group answer before you end the exercise.

b. If both answer "Yes," end the exercise and begin the discussion.

7. Announce to the students that the lines are not equal in length. Attempt to elicit from the students with whom you did not make arrangements how they felt when they heard the other students disagree with them. Discuss peer pressure.

POINTS FOR DISCUSSION:

1. How is this process of conformity involved in other situations, like a jury?

2. How does this "pressure effect" relate to the importance of the verdicts decided upon by juries?

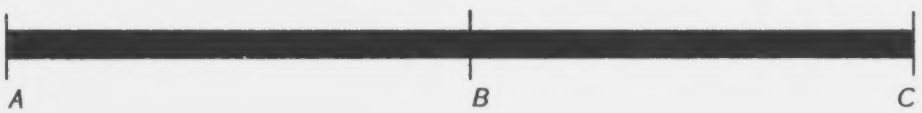
3. What possible ways are there for avoiding or ignoring group or peer pressure?

4. What possible ways are there for dealing with group or peer pressure?

Poster Sample

ARE THE LINES THE
SAME LENGTH?

Use a ruler to determine if line AB is the same length as line BC.



VI.2 TO TELL THE TRUTH

OBJECTIVE: To have the students practice distinguishing among statements of fact, statements of personal taste, and value judgments.

SUMMARY: Students play a game in which three people claim to be the same person. Students have to decide who is telling the truth based on the type of statements spoken.

MATERIALS: None.

TIME NEEDED: 15 minutes.

DIRECTIONS:

1. "To Tell the Truth" is played with three contestants, each claiming to be a certain celebrity. Two of the contestants are imposters. One is the real celebrity. All three contestants answer questions from panelists. The questions panelists ask are designed to weed out imposters, revealing the identity of the celebrity. After questioning is completed, each panelist chooses the contestant believed to be the real one. The celebrity is then asked to stand up and identify him or herself.

2. In this activity, the teacher will choose three contestants and a moderator from the class. The remainder of the class will serve as panelists.

3. The three contestants quietly decide which one of them will play the celebrity role. The chosen celebrity decides which <u>one</u> of these three roles to play:

   Mr./Ms. G. Washington - who makes only factual statements, or
   Mr./Ms. J. Adams - who makes only statements of personal taste, or
   Mr./Ms. T. Jefferson - who makes only value judgments.

4. The contestants whisper their decision to the moderator. The moderator introduces the contestants to the class, saying that all three claim to be "the real T. Jefferson, who speaks only in value judgments."

DIRECTIONS (continued):

5. The class of "panelists" has five minutes to direct as many questions as possible to the contestants. The moderator calls on the panelists to ask their questions one by one. The questions can be about any topic.

6. The two imposters answer the questions by making all three kinds of statements: factual, personal taste, value judgments. The real celebrity must answer all questions using only one type of statement. The imposters help disguise the identity of the real celebrity by answering many of their questions using his same type of statement.

7. After five minutes the moderator cuts off questions and calls for a vote. He or she records the number of votes for each contestant. Then the moderator asks the real celebrity to stand up.

8. The game is played again with new contestants and new roles. Different names may be associated with the roles. For instance:

   Mr./Ms. D. Madison - who makes only factual statements.

POINTS FOR DISCUSSION:

1. Ask students how they went about deciding who was the real celebrity.

2. Read a passage from a book, magazine, or newspaper and pick out statements of fact, statements of personal taste, and value judgments.

VI.3 YOU BE THE JUDGE

OBJECTIVE: To encourage students to think about a controversial issue.

SUMMARY: Class conducts a mock trial to decide what to believe regarding a controversial issue, such as who was the greater president, Washington or Lincoln? Or, is nuclear energy safe?

MATERIALS: Students use the library for research.

TIME NEEDED: 30 minutes (plus research time).

DIRECTIONS:

1. Announce the issue to be decided and assign roles: team for the prosecution, defense team, judge, and jury.
2. Give each team time to research their case.
3. Turn the class over to the judge, who will call on each team to present their case to the jury (allow the judge to question each team.)
4. Ask the jury to deliberate and reach a decision (try for consensus.)

POINTS FOR DISCUSSION:

1. Why is it important to gather facts before making a judgment?
2. How can we avoid jumping to conclusions?

VI.4 CONSUMER RESEARCH

OBJECTIVE: To use research skills to decide which brand of a product is the best value.

SUMMARY: Students place themselves in the role of consumer researchers to determine which of four to six brands of a product is the best value.

MATERIALS: Chalkboard and chalk. Four to six brands of the same product. Brands selected should represent a range in price, quality, and design. Product might be dish detergents, paper towels, all purpose cleaners, etc.

TIME NEEDED: 30 minutes over two days (plus time for research).

DIRECTIONS:

1. Ask students to describe the uses of the product and characteristics necessary for those uses. List these on the chalkboard.
2. Form small groups of students and have each group generate specific hypotheses: (_____ is the best brand because....)
3. Have students decide how to test their hypotheses. Assign the tests as homework.
4. The next day, allow groups to meet to analyze their information. Tell them to make sure their tests reflected normal uses for the product.
5. Call on different groups to state their conclusions and tell how they arrived at them.

POINTS FOR DISCUSSION:

1. Did the class agree? Why or why not? (Were the criteria and/or values different?)
2. Is it useful to do this type of research about the products we use regularly? Why or why not?

VI.5 FOOD SHOPPING BLUES

OBJECTIVE: To understand the common decision-making problems of a consumer.

SUMMARY: Students develop and play a game of shopping at a supermarket for weekly food supplies.

MATERIALS: Dice, large piece of poster paper, felt tip pens, paste or glue, pictures of products, different coins to use as game tokens, paper, and pencil.

TIME NEEDED: One hour for making the gameboard. (May be done as homework.) Each game takes 10 to 20 minutes.

DIRECTIONS:

1. Have students list some foods they eat often. Talk about food "needs" and "wants" and relate this to the idea of a food budget.

2. Assign students the task of creating a gameboard that resembles the aisles in a supermarket. (Draw a winding game path on poster paper with a felt tip pen.) Have students label areas according to the general kinds of goods found in a supermarket (e.g., meats, frozen foods, vegetables, fruits, bread, dairy products, and household (non-consumable) items.

3. If time permits, have students draw or find representative pictures of the different products for each general category. Cut them out and paste them on the board on their respective aisles. If time is limited, just print names of products on the board.

4. Make each product a space on the board and price each product. Consider the possibility of also creating sales spaces and "sale" cards where percentages off certain products are possible.

5. Draw a register (or use a picture) at the end of the gameboard.

6. Discuss the rules for the game. Explain that to play the game you throw the dice and move the coins around the board landing on spaces. When you land on a space, you have the option of buying that item. The object of the game is to buy enough food for the week without running over a predetermined budget limit.

7. *Set a budget limit and team students to play the game.*

POINTS FOR DISCUSSION:

1. *Why are budgets useful?*
2. *Is having many products to choose from good or bad (confusing)?*

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